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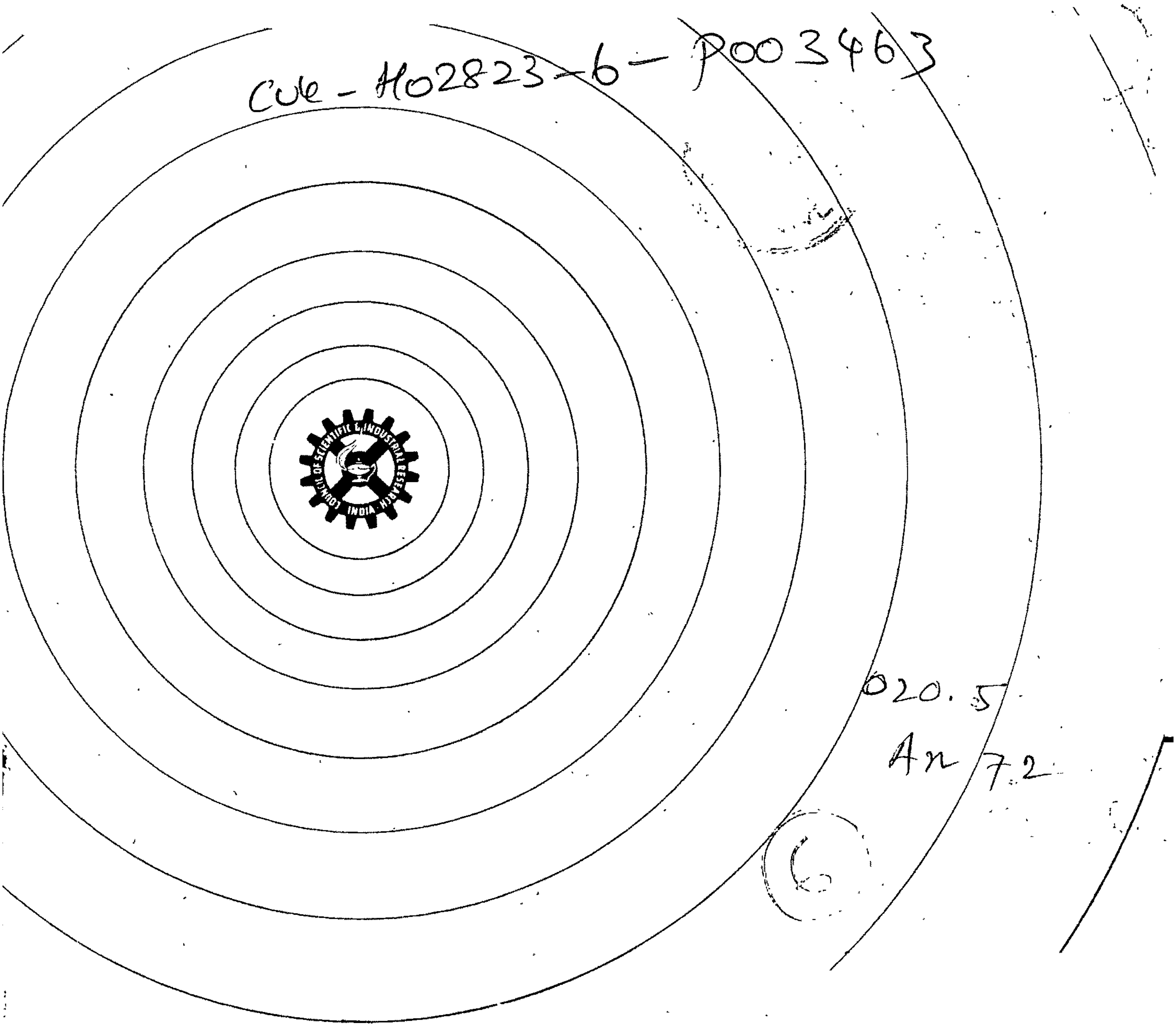

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Proceedings of the

SEMINAR ON AUTOMATION PROBLEMS IN UNIVERSITY LIBRARIES AND SPECIAL LIBRARIES

The Seminar was organised by the Indian National Scientific Documentation Centre from 6th to 8th May 1969. The Seminar provided an opportunity for the computer scientists and librarians to meet on a common platform and discuss the problems and possibilities of computer applications to library and information retrieval work in the context of the facilities available in the country. This being the first seminar of its kind in India great interest was evinced, in all quarters, in its deliberations. This issue of the Annals is publishing the papers, with discussions, of the first four sessions only. The rest of the papers will be published in the next issue. The Sessions Schedule and a list of the participants are also provided in this issue.

SESSIONS SCHEDULE

Session - A

6th May, 11.00 AM - 1.00 PM
Chairman: Mr B.S. Kesavan
Rapporteur: Mr D.S.R. Murty
Subject: Review of the state-of-art of computer application for library operation
Papers: 1. B. Guha, T.N. Rajan & A.R. Chakraborty: Automation in libraries - a short review
2. V.P. Kapur: Adaptive information retrieval system for optimising research

Session - B

6th May, 2.30 PM - 5.30 PM
Chairman: Dr. M.B. Vajifdar
Rapporteur: Shri S.N. Sur
Subject: Review of the computer facilities available in India and study of their feasibility for Automation of Library Operations
Paper: A.S. Raizada: Applicability of Computer Installations in India for Library work

Session - C

7th May, 10.30 AM - 11.30 AM
Chairman: Shri S. Parthasarathy
Rapporteur: Shri L.J. Haravu
Subject: Preparation of Union Catalogue
Paper: A.S. Raizada, N.C. Khandekar & S.N. Sur: Computerised compilation of Union Catalogue

Session - D

7th May, 12.00 NOON - 1.00 PM
Chairman: Shri Dhanpat Rai
Rapporteur: Shri P.K. Sinha
Subject: Control of current periodical records
Paper: L.J. Haravu: Computerising acquisition routines of serials

Session - E

7th May, 2.30 PM - 3.30 PM
Chairman: Dr. B.V.R. Rao
Rapporteur: Shri R.C. Ardey
Subject: Application in other library fields
Papers: 1. Subhas C. Biswas: Approaches to Automated Systems in large Academic Libraries
2. A.R. Chakraborty: Formalising Library Problems by Symbolic Logic
3. K.S. Deshpande: A note on the need for Automation in Cataloguing

Session - F

7th May, 3.45 PM - 5.00 PM
Chairman: Shri S. Dutta
Rapporteur: Shri M. Ramachandran
Subject: Preparation of Indexes
Papers: 1. A.S. Raizada, A.M. Arora & D. Elhence: Preparation of Indexes
2. Ram D. Taneja & Vinod K. Saxena: Compilation of computerised indexes - need for broader guidelines and criteria

Session - G

8th May, 10.30 AM - 11.30 AM
Chairman: Dr. Viswanathan
Rapporteur: Shri T. Radhakrishnan
Subject: Need for the development of a special purpose computer for library and information work: Librarians view

Session - H

8th May, 2.30 PM - 4.15 PM
Chairman: Shri N.C. Khandekar
Rapporteur: Shri A.M. Arora
Subject: Need for the development of a special purpose computer for Library and Information work: View of the computer specialists

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Director-General,
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While inaugurating this Seminar I would take the opportunity of touching on one or two points. When an invitation to attend this Seminar was sent to a librarian, he immediately wrote back rather surprised that such a Seminar was being held. He said when our university libraries and special libraries lack some elementary dimensions in the way of reading space, good shelving, reliable catalogues, good periodical literature and the rest, what is all this talk about using computers in university libraries and special libraries. He also queried the propriety of discussing this topic when our manpower is so generously available. These are valid questions. My personal sympathies are with my young friend. However, I should like to assure him that discussing this topic does not necessarily mean that from tomorrow onward, all our university libraries and special libraries will start availing themselves of computer facilities. Sophistication has to be undertaken on merits and not on moods. The reason why this seminar is being held is to discuss how the computer could fit into the economy of a developing country's libraries, without in any way causing any sort of imbalance. That our catalogues are not uptodate, our shelving lack a lot of finesse, our reading spaces are not well-lit, our stock of book and periodical material is not very plentiful, I do not doubt. The question is whether we should not worry at all about the impact that computer technology is making on information handling. When it comes to compiling union catalogues, cumulative indexes, analytical statements about manpower and resources all of which have to be produced very quickly, keeping in pace with the output of literature in the various fields, should we not, in the interests of promptness and some speed, consider what repetitive processes could be dealt with successfully by the use of the computer facilities already available in the country. This is an open question. A Documentation Centre like the INSDOC with its international context and its national responsibility, cannot afford to neglect a very significant development in the information field. It must have a core of people trained and expert in this matter such that if need arises, as in the aeronautics and electronics fields, this group can without difficulty programme projects in the field of information retrieval. I am very happy to find that INSDOC has already flexed its muscles in this direction and produced author and subject indexes, keyword indexes, cumulative indexes, a print-out of a regional union catalogue and a roster of scientific translators, using computer techniques. The libraries of our Institutes of Technology and other massive science libraries belonging to the agricultural, medical and other complexes must experiment as to how their accession records, their charging records, even their very catalogues could be kept up-to-date by new techniques. Therefore, this Seminar is a bit of loud thinking wherein computerwallas and no-computerwallas can have their fullest say and arrive at rational decisions. I am glad to find that not only librarians and information scientists but computer technologists and scientists are also taking part in this Seminar. I welcome you all to this gathering which is meeting under a very heavy shadow of national mourning.

AUTOMATION IN LIBRARIES — A SHORT REVIEW

B Guha
T N Rajan
A R Chakraborty

Reviews the literature pertaining to the use of the Computer in library and information work. The areas included acquisition, serials control, circulation, catalogue preparation, information retrieval and cost of operations. A bibliography of eighty references dealing with the areas mentioned above, collects the literature surveyed.

INTRODUCTION

The literature on library automation during the sixties, with which we are mainly concerned in the present review, is replete with such out-right assertions that library automation is possible, fruitful and even inevitable, and it is only a matter of an administrative decision for any library as to when exactly to go in for automation. On the other hand, it is not difficult to find in the literature of the same period, more cautious notes and even voices of scepticism. A very widespread belief among the lesser enthusiasts, has been that automation could be possible only in very large libraries, both in terms of turnover and resources. But till 1967, when the Special Libraries Association Documentation Division Survey (15, 17) report was available, one had very little idea as to how large a library had to be, to satisfy this prerequisite. The report of this Survey based on 6,150 replies from the United States and Canadian libraries revealed that 638 libraries had mechanized one or more functions and 842 libraries had definite automation plans. The most interesting revelation was that the typical mechanised library was a university or special library with a collection of over fifty thousand books, more than one thousand periodical titles. but only a small collection of technical reports, with a staff of at least ten but not more than twenty members evenly divided between professionals and non-professionals. In most cases the facilities of the library's host organisation were used rather than machine equipment owned or leased by the library.

If the above findings can be relied, then it can be easily said that many of the university and special libraries in India, are large enough to be mechanised and in many cases similar opportunities to share computer facilities of the host organisation already exist. It would surely be wise to take note of the experiences of those who had made experiments, shown the difficulties and have brought about improvements in computer application to library work, sorted out the areas where computer applications promises to be most successful and make a sound beginning. With this end in view, we are attempting a review of some of the important works published in the past decade in the following pages.

Surveys and Reviews

The best possible overview in the field of library automation, bringing out the potentialities of mechanised devices, progress made, difficulties faced, equipment used and areas of applications, till 1966, is provided by a comprehensive survey by Coblans (11). The survey takes into account both library housekeeping operations and mechanised information retrieval problems in a number of countries. Among the housekeeping operations — with which we are primarily concerned here — discussed are the catalogue, periodicals, union catalogue, circulation and acquisition. Coblans has pointed out two diametrically opposed points of view on the very basic question of automation. One view is that of the 'whole hog' school and the other that of the 'housekeeping' school. The former view is that unless the entire process of information retrieval, i. e. the file organisation, storage and search, is mechanised there is no point in talking about automation. The 'housekeeping' school, on the other hand, considers the interrogation consoles, television screens, and instant printouts from a selected document, as promised by the former school, to be unrealistic and undesirable. They prefer step-by-step mechanisation. The mechanised files would be used for routine processing and production of records, including indexes and bibliographies. For such work, standard equipment was available which would permit the mechanisation in libraries of clerical tasks that could be formalised at costs comparable with manual operations.

Summarising the progress made in housekeeping operations, the survey observed, "It is widely claimed that the use of mechanised systems in house-keeping has a number of advantages, of course it also introduces a number of difficulties". Advantages by way of more efficient and effective library operations and savings in clerical costs were claimed. Among the difficulties mentioned are increasing programming costs for libraries which tried to share on-line computer time and typographical limitations of the mechanical printer. One important observation was that it was difficult to compare the costs as between manual and mechanised operation because traditional methods have hardly ever been costed or analysed in deep enough detail.

After Coblan's survey we have on hand the first two volumes of the Annual Review of Information Science and Technology (7, 21). In each of these volumes a chapter has been devoted to library automation. Both the review articles mention a number of significant library operation projects along with mechanised information retrieval systems. The first review observes the coming into print, of a large number of hortatory articles which explain why automation is the coming thing and why one really ought to become acquainted with what machines can do and so on, but there are far less number of articles on systems in operation or planned in particular libraries. From a review of the literature of 1966, the second reviewer feels that the single most important facet is that the literature clearly reveals that there is a vast and growing number of marchers — librarians, computer specialists, system analysts, and information entrepreneurs — that there is an ongoing search for a modus vivendi between the library world and that of the specialised information centre, and that at least minimum standards for machine-processable data are almost upon us. The reviewer complains that there still are serious gaps in the literature. We need general articles for the policy makers explaining what we are trying to accomplish with library automation and why it is important. An article by Ben-Ami Lipetz is cited as an excellent example of this type (20).

Some guides to library automation

While the foregoing account introduces the basic literature to have an idea of the extent automation has been applied to library and information work, the following section deals with a couple of books specially meant to introduce librarians to computer applications and the computer experts to library operations. The book entitled the Computer and the Library, (14) hailed as one of the best books of 1966 by Markuson (21) written jointly by two computer experts and a librarian, tries to present a good view of the possibilities and difficulties of using the computer to certain library operations. After dealing with the library as a component in the whole structure and framework of information transfer, the authors focus attention on the fact that much library work is concerned with the creation, consultation, amendment and up-dating of records of books and it is these tasks that are amenable to machine handling. The computers could be successfully employed for various operations carried on now through different records and files, one of the essential advantage being the possibility to generate several records from a single record, in a purely machine operation. The computerisation of the order and issue system and the cataloguing and bibliography work are then discussed in detail in the following two chapters. A chapter is devoted to 'Computers; their uses and limitation' to give an idea of the computers working, for librarians, which perhaps is a little too condensed for beginners. The authors end up by pointing to the necessity for the computer experts and the librarians to come nearer, to have a better understanding of each other's specialisation, thus developing a sensible dialogue between them in the use of the computer for library operations.

The second book of interest to computer experts and librarians alike is Kimber's Automation in Libraries (18). In this work, the author envisages a complete computerised system for the clerical and administrative operations which are concerned with a library's internal housekeeping. The chapter 'Introduction to Computers' by Anne H Boyd, provides a basic introduction to computer methods, aimed primarily at librarians. The examination of the problems necessary to introduce a mechanised system for library operations is discussed in the first chapter, followed by separate chapters giving detailed descriptions of the specific operations such as ordering and acquisition, circulation control, periodical listing and accessioning, catalogue and bibliographies. Block diagrams explaining the different files that could be generated from a central file are given in each of the chapters dealing with a specific function, enabling one to have a clear view of the advantages of mechanising the formal and repetetive works in the library.

The final chapter giving a survey of the present state of automation in libraries, is particularly significant in that it affords a comparison of automated system for specific operations in ideal conditions described in the earlier chapters, with real-life operation systems experimented at various libraries thoughout the world. In conclusion, the author distinguishes two general directions in which computer aided library services are likely to develop in the future. "Printed lists prepared by computer processing of a large corpus of bibliographic records will increase in number and in diversity and facilities for on-line interrogations of files held in machine memories will become more widely available". While automation will certainly simplify many of the library operations, it must be built upon a sure foundation of good library practice. Indeed this calls for a close working relationship between computer experts and librarians.

Kimber as the editor of the new journal Program: News of computers in British libraries, has also been supplying useful and uptodate information on the use of computers in British libraries, since 1966. The first number of the second volume of this journal is reviewed in the Library Association Record (13) which states that this journal will in future be closely associated with Aslib's Mechanisation Group and in fact will be publishing organ for this Group. To quote from the review, "the articles in Program are detailed and practical, and at the moment easily understandable by any librarian interested in automated systems."

Automation of specific library operations

Coming to consider the areas where it has been possible to use the computer, it would be worthwhile to take note of a survey and its analysis of the progress up to the beginning of 1965, by Jahoda and Accola (33). Surveying the available literature, they selected twenty five projects for using the machine mainly in housekeeping operations in government, industrial, public and university libraries in the United States mostly, for a detailed comparison of their operation, volume of work handled, nature of work done, costs, etc. It is interesting to note that all had shown improvements in service, eighteen reported savings in personnel or overall costs and fourteen had inventory control. It was observed however, that machines could be advantageous in library record keeping when two conditions existed: 1) A basic record could be used for a variety of purposes; and 2) Cost of development and programming could be shared by a number of libraries. In a way the findings of this survey provides the best answer to the frequently asked question — 'Has experience borne out the hope that computer processing could considerably simplify library housekeeping?' This report shows that 13 out of 25 libraries had chosen to automate the serials acquisition work, fourteen libraries were producing their complete serial holdings, 13 libraries were doing their cataloguing work, the same number circulation work also, and eight libraries had chosen acquisition work. Reasons for developing machine based systems varied, but 11 installations gave as one of their reasons an increase in volume of work caused by either a higher acquisition rate or demand for more extensive service, or both, without corresponding increase in manpower. Surely, most of us will find here a very close parallelism with our conditions. Twelve installations stated the need for more complete and up-to-date records in different physical locations. One of the reasons included, a desire to experiment with more sophisticated systems, and availability of equipment. On the whole, the surveyers felt, there were convincing evidence that carefully planned and executed machine-based systems could indeed improve the effectiveness and efficiency of library operations.

In the next few paragraphs we propose to discuss some of the common library operations, like acquisition, serials control, circulation and cataloguing, where computers have been actually used and try to see what exactly they can do for us in these operations.

Acquisition

It is reported in the literature that automation of acquisition activity is generally very successful, the reason being that methods employed for this work in libraries are simple and straight forward. A computer aided acquisition programme can undertake a number of routine clerical processer and bring out a wide range of outputs, giving the librarian full control over operations and permitting good reader-service in the form of various reports and lists.

The main operations in an acquisition section are usually as follows:

1. Collecting bibliographical information about items proposed for acquisition.
2. Checking the catalogue or other lists to see whether an item is already available.
3. Preparation of the orders to be sent out to booksellers or vendors.
4. Maintenance of a file of all items on order — both for staff and readers.
5. Detection of delay and sending out of reminders.
6. Checking-in of items received and preparation of processing slips, accessioning, accounting procedures for payment of bills and control of the book fund.

In the conventional acquisition procedure the proposed items are recorded in individual standard slips. These slips are arranged and rearranged to create different files, e. g. it would be expedient to arrange them alphabetically by author or title and rearrange them according to the names of booksellers when the orders are to be placed. The actual orders are in effect creation of new records from the basic record in slips. Again, after the orders have been issued the slips may have to be rearranged to create new file or files. Copies of orders arranged by order numbers will have to be maintained to receive and incorporate reports from booksellers. For reader service duplicate copies of slips may be filed in the public catalogue to indicate books on order. Any other form of announcement will mean creating new records. When, finally the books are received the slips are usually arranged according to the accession numbers.

It would be apparent that the first operation, listed above, is hardly amenable to automation. If the catalogue is in machine readable form then the second operation can come under machine handling, as it would mean simple matching operation. It would be also apparent from the diagram that the central parts of the system is a machine readable order file. This file will always remain in the same order, e. g. author and title. But the new records created from this main file can be obtained from it in any desired order as print out. When information is received from the booksellers regarding items on order or a book arrives the corresponding item in the main order file has to be approached and the record updated. It is to be noted that for such operations new input records have to be created everytime. To effect easy link-up of the new record with the main file abbreviations and codes are usually used. In this regard the device of 'status symbols' designed by the Pennsylvania State University, which can provide a complete control over the status or position of an ordered item, is of considerable interest (38).

On final analysis, it can be seen that an automated system has the capability of producing a number of records as output. This can be well utilised not only to control routine operations but to improve reader-service also. In fact some installations are thinking of linking the main order file with SDI service or personalised announcement.

References (35-39) pertain to the working of automated acquisition system.

Serials control

The periodicals section of a library has to maintain quite a few records for efficient control and service of the material in its charge. The bibliographical nature of a periodical demands a continuous check on the timely payment of its subscription, timely arrival of each issue or parts, sending out claims for issues which do not arrive in time, preparation of binding slip when a volume is completed and so. On the service side the section has to maintain a complete and up-to-date holdings list and has to announce arrivals of new issues at fixed intervals. Generally speaking the working of the section can be described in terms for the following basic operations:

1. Creation and maintenance of a file of all current periodicals;
2. Accessioning or check-in of issues received in the section;
3. Detection and claiming of issues which do not arrive on time;
4. Preparation of binding slips for completed volumes;
5. Preparation of list of titles and volumes sent for binding;
6. Preparation of list or lists for renewal of subscriptions;
7. Preparation of lists of periodicals and parts received during a week or fortnight; and
8. Preparation of complete and up-to-date holdings list.

In a conventional system the main file is in Kardex or organised in a similar way, wherein the titles of all current periodicals are arranged alphabetically. The operations 2 and 3 depend very much on this file. Check-in is very quick and easy in the sense that no new record is created at this stage but only new information is added to the existing record. For all the subsequent operations including claims for issues not received, new records are created although information is largely taken from the basic record in Kardex or directly from the issues themselves.

Types of data that are usually handled in the preparation and updating of records in these operations are:

1. Title of periodical;
2. Frequency of publication;
3. Address of publisher and vendor (if subscribed);
4. Information about subscription;
5. Volume, Nos, etc. (issue per volume); and
6. Mode of acquisition — subscription, exchange, gift, etc.

Keeping in view the main operations as listed earlier, let us consider the acutal working. The main file consisting of all the details of each current periodical has to be in machine readable form in, say, magnetic tape in some order. Usually this is kept in alphabetical order. As it takes some time to secure this order by handling complete titles of periodicals, this is, usually secured by assigning some code or abbreviation to each title. At present the CODEN abbreviations are being used profitably.

When a new issue of a title comes into the library the information about the new arrival, its date of receipt etc., have to be incorporated into the corresponding record in the main file (operation 2). Here it can be easily seen that for each issue a new input card has to be created to approach the main file. In the operational automated systems this difficulty has been tried to be obviated in the simple device of prepunched check-in-or arrival cards prepared by the computer in the expectation of the arrivals of issues during a month or a fortnight. Since the main file is in alphabetical order the bunch of check-in cards will also be in the same order. When a new issue comes the check-in clerk has to find the corresponding card. Information about the date of arrival has to be punched, if information about volume, issue No., etc., have already been punched. This can be done at the end of the day by gang punch.

After the end of the month, the unused check-in-cards represent the probable claims. Each case has to be divided by the librarian. From the check-in-cards which have been used, the weekly list of arrivals may be prepared (operation 7). Finally they are used for updating the main file.

e the computer to prepare the ards correctly the frequency and arrival pattern of its issues are to be dicated by appropriate code in the main file. Too many unused check-in cards in any month is an indication that this calculation has not been done properly. It can be observed that the vagaries of both publishing and postal service can completely put out of gear the working of such a system.

Operations 4 to 8 are merely preparation of lists of various types. It is quite likely that the mechanised system would be able to produce quickly these lists from the main file. Of course, the main file will have to keep in its record some data than have been mentioned earlier, e. g. expected date of arrival for each title and binding instructions can be easily be said to be most important data.

The main operations and their corresponding file or data manipulation are summarised as follows:

Operations relating	Manual	Machine
1. Current serials file	Kardex — in alphabetical order.	Master record in machine readable form-arranged by alphabetical codes for titles, e. g. CODEN.
2. Check-in (for issues recd.)	Kardex-volume, issue Nos. etc. noted for each new arrival.	Picking out and matching of 'check-in cards from an alphabetical file prepared by the computer in expectation arrivals of issues.
3. Claims for issues not received.	Detection by the use of coloured signals or check card. Sending out of reminders in forms.	Unused check-in-cards give indication for probable claims. Reminders can be printed by the computer on forms.
4. Delays	Replies about delays can be noted in the Kardex.	Can be noted (in machine readable form only- in code form).
5. Unexpected arrivals	No problems in Kardex If check card is used it may be difficult to locate the check card.	Lead to serious problems
6. Binding	List of completed vols. cannot be obtained quickly.	A print out giving the vols. completed can be obtained quickly. Binding slips can also be prepared.
7. Renewal List	Has to be prepared separately.	Print out can be obtained from the same basic record.
8. List of periodicals recd. during a period.	Has to be prepared separately.	Computer print out can be obtained quickly.
9. Catalogue of holdings.	Has to be prepared separately.	New information can be updated quickly and a complete catalogue in book form obtained.

References for the working of automated serials control systems have been cited as items (40-47).

Circulation control

Circulation work in libraries pertains to issue of books on loan, getting them back after they are returned, making reservations for items on loan wanted by readers, maintaining record of files for having full control of circulation and collecting useful statistics. These tasks require the maintenance of files relating to the following information:

1. Information about the book issued and to whom;
2. Information about the borrower and what book/books has he;
3. Which books are due for return at a particular date?
4. What books are on reserve and for whom?

The two important features that characterise a good charging system are the speed with which books are charged or discharged, and at the same time obtaining accurate information about the item charged. Most manual systems are designed keeping these two points in view. But the maintenance of files relating to circulation are obviously kept to the minimum. What files are to be kept depends on the local situation. Usually the loan file is arranged chronologically according the date of return of the books, within which the items are arranged by subject. Thus we see in the Browne System, for instance, the time taken to charge or discharge books is the least, as the information about the books and the borrower are collected well in advance of the transaction. But in the organisation of the loan file, the system would not be able to provide quick service in locating a particular loaned item, unless a search of the entire file is made. Again when information is required, as to what books are loaned to a particular reader, the information cannot be obtained unless a new file is kept arranged by the name of the borrower and books taken by him. In fact, none of the manual systems can supply all the particulars noted above (1-4) without becoming cumbersome. But in a large university library, the situation may demand a fool-proof and tight control of circulation and it is in such condition, where there is enough quantity of data to be controlled, that the computer offers relief and help.

In a computer aided circulation - control system, both books and readers are given identification cards in machine readable form. A new transaction record is prepared at the time of charging and fed into a magnetic tape or disc. This loan file is normally arranged by the accession number of the book. The book and borrowers card are coded in such a way that the computer could determine the appropriate loan period for each transaction when the date of issue is recorded in the loan file. When a book is returned, the book number of the loaned item together with a special discharge code is again fed into the computer, thus enabling the charge record to be wiped out after a match.

When there is a request for reservation for a particular book on loan, the identification number of the borrower is added to the loan record for that book in the loan file. In doing this, a special input record is created giving the readers number and the book number concerned and so identified as to distinguish it from the charge record.

Information relating to recall, overdue etc. is automatically obtained and the necessary letters to readers are also sent at the appropriate time. The central loan file could be manipulated in a number of ways to provide lists of various kinds, thus proving very valuable to have a tight control of circulation.

In an off-line computer circulation system, information relating to loans, return, reserve, etc. are collected chronologically as they happen, and this 'unordered file' has to be again organised to build up the final loan file/ arranged according to the accession number of the book. It is this file which will have to be kept up-to-date for controlling circulation. It is seen from the literature that an on-line automated circulation system would be ideally suited for circulation work, as this will eliminate the necessity of the preliminary 'unordered file'.

The various operations and their corresponding file or data manipulation may be summarised as follows:

Operation relating to	Manual e.g. Browne.	Machine
1. Charging	Book cards and readers tickets are coupled. The book is charged after stamping the date of return on the date lable.	Machine readable book and borrower cards are used to register the transaction on the magnetic tape. The book is charged out on loan after this. Charging takes a little more time than the manual system.
2. Discharging	The coupled book and readers ticket is separated with the help of the date of return. The book card goes into the book and reader gets back his ticket. There is no record of the transaction thereafter.	The book number of the book and the special code for discharging are obtained in the machine readable form and later fed into the computer. A final matching between the two will record the end of the transaction. This record could be kept for any information about the borrower.
3. Control	The loan file is arranged according to the dates of return, within which each item is organised by subjet. This facilitates to locate a book as to when it is due but not anything more.	The loan file is arranged according to the accession number with the full particulars of loan following. The loan file could be manipulated in a number of ways to get the desired information.
4. Reservation	Renewal requests are indicated by a flag attached to the book in the loan file. The renewal requests are arranged separately by the call number of the book.	Borrowers' identification card coupled with the book number, with a special code signal will distinugish easily the renewal requests.
5. Intimation to readers regarding reservations overdue renewal, etc.,	Loan file will have to be systematically scanned and checked for action to be taken on overdue, reservations, etc. Letters are to be sent thereafter.	Information relating to overdue, recall, etc. are obtained atomatically and letters sent.

Of the several systems developed for computerised circulation in libraries, mention may be made of the Lehigh University Library's Mechanised Circulation System. In this system, "Loans are recorded from key punched book cards and borrower's identification badges by means of an IBM 357 data collector to produce a transaction card file. Daily transfer of this card file to magnetic tape produces an updated printout as well as a current statistical analysis. The mechanised system has not saved operating cost, but full and reliable control of circulation has been achieved." (49).

The Queens University of Belfast has undertaken a research project to evaluate thoroughly the performance of an on-line circulation system and to determine its real cost (18).

Kimber reports of a typical computer-aided circulation control system which is now in operation at the University of Southampton.

Other references are given in the bibliography (18).

Catalogue preparation

The catalogue of a library is undoubtedly the most important and the largest record and is the key with which access to all knowledge embodied in the collection is obtained both by the readers and the library staff. Naturally, attempts have been made to apply computer processing techniques in the preparation and maintenance of this record. From a survey of the literature it becomes obvious that what has been achieved so far cannot be termed as computerized cataloguing but at lest we described as computer aided cataloguing. The computer has been able to assist in cataloguing in two ways only. Primarily it helps to create a multiplicity of catalogue entries from one basic master record which forms the input to the computer. But, unfortunately the limitations of the available character in a computer line printer has prevented many libraries from using the line printer for the actual printing of the cards. In some cases it is being done through the intermediary of a tape type-writer. Another job which a computer can do is to arrange the entries in order. A set of cards (main entries and all added entries) can be printed on a line printer in the same order in which they will be filed in the card catalogue, which eliminates the preliminary sorting work before actual filing.

The advantages claimed for an automated system of cataloguing are mainly relating to the updating facilities in any desired order, possibilities of producing the catalogue in book form in multiple copies, more frequent announcements of new accessions in different form like reading lists by subject, language etc. and the great possibility of bibliographic data transmission to and from other institutions.

Since the beginning of the present century the book form of catalogue, in spite of its many advantages, vanished from all service libraries because of its slow and poor updating facilities. Using the computer for quick merging and refiling of bibliographical data and the computer printout for the preparation of catalogue, holds out a great promist for the reappearance of the book form catalogue. This point has been stressed by all those who have changed over to computer production of catalogues.

The most important trend in this area has been a new turn and a new promise regarding centralised and shared cataloguing. It is quite likely that automation will fulfil the librarian's long cherished dream of centralised and shared cataloguing. The Library of Congress MARC (Machine Readable Catalog) Project is a definite pointer in this direction (57-58). Very soon this library will be able to transmit cataloguing data via magnetic tape reels and the receiving libraries will be able to manipulate and reformat this standardised catalogue record in local installations to serve local practices and needs. It is quite likely that in the near future a number of national libraries and national bibliographic centres would be able to transmit and exchange cataloguing information of their respective publications in machine readable form, so that such a centre would be in a position to act as the national centre of the country for purposes of centralised cataloguing. But full participation for a national agency in such a system of world wide centralised cataloguing scheme would be possible only through automation. Britain has already been influenced by this idea (53).

In recent literature we find an account of automation of a national bibliography, the "Deutsche Bibliographie" of West Germany (52). It is published in several series and different issues. As a result of automation, each issue is now able to carry author-keyword index and a publisher index and they are frequently cumulated. The semi-annual cumulations of the entire bibliography (bibliographical part and the indexes) are easier to produce and come in time.

Additional articles of interest are given as references (52-59). In reference (58A) based on the experience of Montgomery County, Maryland, a cost comparison has been given for card catalogue and its automated book catalogue operations. The latter is shown to be slightly cheaper.

Information Retrieval (IR)

As has been pointed out that even the protagonists of the house-keeping school believes in the step-by-step introduction of complete mechanisation, otherwise the immense potentialities of the computer cannot be fully utilised. Pioneers have already started exploring the possibilities for completely automated information retrieval. New horizons have been opened in this area with the recent developments in computer technology.

Briefly, there exists the possibility of searching for information through interrogation consoles attached to a high speed computer visual transposition of information through electronic means into various modes of storage for later recall, and visual presentation of electronical evaluated information processed by computer facilities. Kimber says as has been pointed out earlier, that it is possible to distinguish two general directions in which computer aided library services will develop. Printed lists prepared by computer processing of basis corpus of bibliographic records will increase in number and in diversity, and facilities for on-line interrogation of files held in machine memories will become more widely available. Activities in the first direction are quite evident by the growing number of computer produced catalogues, bibliographies, current awareness lists, KWIC indexes, Citation indexes, and all that. Activities in the second direction have so far been mainly experimental. Automation of information retrieval has, as its ultimate aim a situation where there should be no intellectual intervention at any point in the cycle, from the entry of the original text into the system to the final provision of the user with what he needs to know about a subject. One of the early reports on the possibilities of computerised information retrieval was by Barnes (60). This report clearly brings out the areas where computer processing may be suitably tried as well as the more difficult areas... where computer processing is likely to be extremely difficult proposition.

It has been well realised that IR has to take in its stride three important areas — organisation of documents, storage and search strategy or retrieval. In the first area comes the most important question of classification or indexing around which the entire system has to revolve. Experiments on this important question have been going on mainly along two lines. One one hand we have experiments which are trying to handle natural language texts and simulate, to a certain extent, human indexing method. Attempts are actually being made in these experiments to derive the most suitable indexing terms by the most simple frequency counting of terms, finding of non-common words appearing frequently, studying the syntactic structure of text, positional clues and semantic clues, theory of clumps, etc. There are even attempts to derive a classification system automatically, applying factor analysis technique (63). On the other hand we have before us a number of experiments in automatic indexing which are actually trying to find alternatives to human process of indexing keeping the input as simple as possible by using as 'tags' any one of the intrinsic characteristics of a document. In this group comes KWIC indexing and all its variants, citation indexing and bibliographic coupling. A valuable report on the state-of-art of automatic indexing has been prepared by Stevens (79). It is certain that for the time being we must be content with computer-aided human indexing.

Perhaps the most comprehensive and completely automated IR systems envisaged so far, though they are science fiction to us, are the Project MAC and the project INTREX (70, 76).

Standardisation and Systems Analysis.

All through the literature on library automation, authors librarians and computer specialists alike, have emphasised on two points. One is the need for highly standardised library practices and records and the other for systems analysis of library operations. A computer can work efficiently with standardised data record only. Librarians generally take pride in the high degree of standardisation of a catalogue entry, evolved through many years of practice and observation. But computer aided cataloguing practices have shown that even this record can be standarised to an even greater extent. A look at a typical 'data sheet' will clearly bring out this point. In fact all the variables in any section of the entry are thought of and provisions made accordingly. The other library records and many processes need much more attention on this point.

The other point of emphasis has been the need for systems analysis of the entire library operations. Here we first need a definition of this new concept. Simms defines a system as "a set arrangement of things related or connected to form a unity or organic whole, a set of facts, principles, rules, etc., classified or arranged in an orderly form so as to show a a logical plan linking the various parts" (78). By analysis we just try to bring out this logical plan. Swanson says, "the point of beginning for systems analysis is therefore a clear formulation of purposes or requirements independent of any particular design for implementation" (80). One of the early attempts to employ this powerful analytical tool to library operations was by Schultheiss and others (77). The advantage of systems analysis and flowcharting is to force one to analyse procedures step by step and to identify and eliminate bottlenecks and duplicated effort and to devise the best or the optimal plan to achieve certain objectives. A very useful paper for a non-specialist in this has been published by Jestes (69), wherein he has applied this technique in analysing the reference room subsystem for locating a book in a reference room. Much more sophisticated are the plans for the systems analysis for the Library of Congress reported by Markuson (72).

Cost of library automation

When all has been said about automation, one question that is usually asked by librarians is at what cost automation can be brought about. Is it within the comparable limits of existing costs of library Service? If a librarians is convinced about the possibilities of improved or additional readers services through automation, he needs to know at what additional cost this could be achieved. But unfortunately, as at present, there is very little scope to give a straight answer to this point. In fact a number of reviewers have pointed out the non-availability of cost data in the literature. In many cases a straightforward cost comparison is not possible becuase we do not know precisely the cost of the existing library services. As has been said that "there are few libraries today which can be considered as existing in order to make a profit for their owners (as a factory or a business firm) or even required to balance an income from subscriptions against their expenses. How, then, can a price be set against the service which a library can provide, and how can this price be measured so that automation may be seen to be justified?" (26). From whatever little is available in the literature it is not difficult to find conflicting reports also. Thus on a relatively simple mechanisation process of using tape typewriter for producing catalogue cards, Mackenzie shows the tape typewriter to be about 75 per cent as costly as either a stencil duplicator or a small offset litho machine (71). Moore on the other hand finds the reverse to be true (74). A complete cost analysis for a conventional card catalogue department and a mechanised department has been done at the Montgomery County Public Libraries which shows mechanised catalogue in book form, is slightly cheaper, (58A). Similarly, a cost comparison between a manual and machine system in circulation work, at the University of California Library, shows that the machine system is much more costly, ($26,975 and $35,277) (66).

It has been made clear in the recent literature that we need some kind of methodology for cost analysis and cost comparison. There are some articles emphasising this point, (64, 66, 67, 68, 71, 74).

Finally, even if automation is costly, it is quite likely that ultimately, it is the user who must decide what is the cost to him if the libraries are not automated. As Vickery puts it, "If machines can cut out repetitive labour, accelerate service, and make information more accessible, how much will our customers lose if we do not use machines? It is upto the librarians to determine what machines and manpower are needed to give full access to information, and what this will cost. The alternative they (users) face is an ever less satisfactory service" (26).

The Future

Library automation is a changing concept. On the one hand computer science and technology is changing very rapidly; on the other libraries are also showing signs of change due to a number of factors, like social changes, government support and the recognition that libraries serve as an intermediary in the process of communication of knowledge. When the libraries are able to show their flexibilities, in response to the social changes and demands, in all aspects of librarianship — library building, library house-keeping, system of subject classification, forms of publications, and the most important of all, in reader services, then it becomes almost imperative to know for the librarians as to how automation can help to bring about improved services in the library. For that a continuing dialogue between the librarian and the computer specialist is needed. Such a dialogue has already started in the West. Should we not start it in our country keeping in view our limited opportunities and special needs?

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ADAPTIVE INFORMATION RETRIEVAL SYSTEM FOR OPTIMISING RESEARCH

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Introduction of theory of adaptive controls, unified theory of value for engineering and decision theory to the retrieval system theory has resulted in number of new developments in information science. The concept of complete bibliography has made it possible for the first time, to work out a strategy of research, involving adaptive control, dynamic programming and learning to the best advantage of the workers. Use of perpetual classification systems would make it possible to reject research into future. The problems presented by present systems, i. e. statistical emperical, on one side and application of theory of graphs and other topological notions, by way of structural matching etc. are based on hypothetical user model, and the logic involved is not rational. A semi-automatic arrangement involving 'human operator would prove to be more effective. A punched card decision device is demonstrated.

Information Retrieval systems, in most practical cases, operate under changing environament. This paper describes how an adaptive information retrieval system can adapt itself to optimise its performance under the influence of uncertain environament. Planning an optimal strategy for research would always involve a 'decision structure' and not an isolated decision. Optimizing each decision would ensure an optimum performance. From the point of view of system engineering a 'critical path' will have to be established, out of various alternatives, available at each node. To have preferred pattern of decision a theory of value is essential. A unified theory of value has been developed by Fishburn [1]. This can be applied to Information retieval systems with suitable modifications. For the purpose of information retrieval system following points are important:

1. Presenting an integrated picture of an individual preferences, useful for guiding the individual to better decision;
2. Resolving uncertainties that may attend an individual's belief about preferences;
3. Interrelating the predictive and prescriptive facts of decision making in a useful and consistent way;
4. Translating rough conceptions of worth and rough statements of objectives into precise value terms;
5. Describing the interactions of preferences among the factors of variables in multivariate alternatives;
6. Presenting an unified picture of the relationships between preferences and uncertainties regarding question of facts;
7. Describing the relationship and disparities between different and interacting value systems; and
8. Specifying a unified method for solving conflicting value systems.

The only other point which has to be kept in mind, is the development of hierarchial system. This notion is very pertinent in control system engineering (Pearson 1966). This consideration implies that retrieval systems invariably involve concept of feedback, policy, application of dynamic programming (Bellman '66) and multi-stage decision making, adaptive control and hierarchy of decision making.

Reference to the above mentioned points indicates that depending upon the elasticity of requirements of research work, a suitable strategy can be worked out. Necessity to create a scale of value or a system of preferences is almost indispensible. Adaptation at each stage of literary work is most important. Dialectic nature of most of the research situations demands a fully qualified query and careful analysis of question of facts (experimental) or use of formal methods to get answers. Hence, the notion of an unqualified user is more fiction than reality. Hence the necessity of sacrificing precision of information retrieval system is, not worthwhile, for hypothetical user. Once a person is interested in real value structure, he will have to face entire challenge indicated in the points discussed above.

So the basis problem resolves itself to: 1) the need for 'contemporaneity' i. e. to be aware of what is currently going on in one's field of work, a need to keep uptodate with current progress; 2) In view of the rapidly growing knowledge system (with half life period of about one year) to know (learn) the supporting terminology and disciplines in shortest possible time.

The first problem is discussed in next paragraph. The second problem is more of learning of existing disciplines. The best strategy of learning has been developed in subsequent paragraphs.

BIBLIOGRAPHIC COUPLING AND COMPREHENSIVE BIBLIOGRAPHY

The author developed a notion of complete bibliography which in turn is based on so-called bibliographic coupling (Kapur '69). Method of coupling is based on unit of bibliographic connection, defined as one item of reference used by two papers (Kessler'63). This has been based on case studies of 36 volumes of Physical Reviews. The frequency of occurrence of such a coupling would fall off as soon as the limits of the complete bibliography are approached. A facet analysis based on such a bibliography would directly give a most comprehensive classification scheme. The concept of a perpetual classification scheme in earlier literature was virtually abandoned in view of the formidable difficulties in the library science literature. Intensive research work on system engineering, learning machines and adaptive control system have indicated the possibilities to develop dynamic or perpetual classification system. Facet analysis would in fact be a conscientious poll of literary circle of experts regarding the necessity and growth of the subject facets. These self-adaptive systems would mark a big achievement in the information retrieval systems. It has been observed (Feitscher'65) that the number of scientists active in a research area double every 15 years. The amount of scientific information doubles every 8 to 10 years. In addition, the narrow specialisations create problems in mutual communication of information available. It is therefore imperative that interscience communication systems be developed, which should have least redundency. Redundency leads to work duplication and as a consequence 45 percent of all the research effort and funds are wasted.

It has become obligatory on the information retrievel systems to incorporate the ideas of dynamically self perpetuating classification systems.

For any successful, economic or biological system, the essential condition is that the system should regenerate and reproduce itself, old forms being replaced by more efficient new forms, in perpetual succession of events. Retrieval system theory cannot be an exception to this rule. Cannonical classification systems are under a constant process of becoming outdated, illsuited to cater for the needs of fast growing universe of knowledge. Introduction of the computer technology and communication engineering (Kanpur '69) has now made it possible to incorporate necessary machanism for so-called 'self-adaptation'.

DYNAMIC PERPETUAL CLASSIFICATION SYSTEMS IN RELATION TO RETRIEVAL SYSTEM THEORY

Study of the developments in the field of retrieval system theory indicates that the attempts can be grouped under the following two classes:

(a) Statistical Information Retrieval System (Parsons '64) based on 'Co-ordinate Concept'. Logic of the method is based on statistical probability, that the desired document will be abstracted with relatively high percentage of identical or synonymous key words. These are used in posing the inquiry concerning the subject of the document. This approach to retrieval allows use of unlimited vocabulary and consequently eliminates the need for dictionary or thesauras. This may be further subdivided into two groups. First, the method of factor analysis (Borko'64) where the occurrence and degree of association of key words is computed. This enables the document content analysis and comparison and determination of number of categories required to describe a set of documents adequately clump analysis by Panker-Rohdes and Needham in which the problem (not yet solved) is location of non-randomly associated terms in Boolean lattice of all possible subjects. Second, 'Latent class analysis by Baker' (not yet emperically applied) in which patterns of key words are used to compute probable class identity.

(b) The other approach is based on topological structure of information system (Chien and Preparata '66). In one of the methods of flexible approach is designed based on Structural Matching Procedure (Salton and Sussengruth '64). These methods make use of theory of graphs. An algorithm has been developed (Sussen Gruth '64) for comparing pairs of structures. These are based on simple concepts of set and graph theory. The main feature of the algorithm is that it avoids back-tracking and trial and error.

The above approach can be considered as analogous to the system engineering concept. Different degrees of emperical reasoning is involved in each. In terms of standards elucidated in the beginning of this paper, this would indicate that various methods ignore different aspects of the retrieval system theory. One of the leading authorities in soil mechanics (Casagrand '65) has expressed opinion that most of the classification systems lack precision and resolution. It is further shown (Goffman '65) that no information retrieval system be represented by finite value system, having single valued truth tables. This theorem implies that no finite valued logic is adequate for representing information retrieval process.

Classification schemes can be compared with codification of Information theory. It is already discussed by Kapur [3] that by making the codes complete or comprehensive we can make the computer designs simpler. From the point of view of computer language normal classification schemes are too primitive. This involves human engineering problems.

Taking into account in detail, nature of the difficulties involved it is quite evident that an information retrieval scheme should have perpetual classification as their basis. Since this approach is akin to an adaptive control system, the facet analysis and decision optimization, be done by human operator. This would involve a multivariate analysis and gives the necessary elasticity for projecting research into future. This is not only a must for an under-developed country like India, the scheme presented here possesses positive advantages over existing retrieval systems. Any research worker as a legitimate user of information system would like to have forecast of the future possibilities, in addition to have current awareness. Most essential premise about learning is that unless one knows the whole before knowing the part understanding will not progress. So it is imperative that the research worker should himself undertake bibliographic work. This would not only make him conscious of the entire research area but would also lead him to an intuitively established set of values so essential to readjust the strategy at each level of his activity, in a hierachy of decisions.

Following the legacy that a semi-automatic retrieval system would lead all the other costly possibilities, the author has developed a manual information selection system based on punched card system.

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DISCUSSION

Mr. Kapoor: Attempts to make use of computers for purposes like cataloging will be uneconomical. Computers have different logic and any attempt to do this sort of job involves communication with the computer which is a great problem which comes under the human engineering problems. Has Insdoc tackled this problem, particularly the economics of computerising of the cataloging operations etc. attempted at the Insdoc?

Mr. Raizada: No such work has been attempted by Insdoc so far. The seminar aims to discuss and collect information on this point. Insdoc is carrying out at present some routine jobs.

The Chairman: Insdoc, at present, is exploring the possibilities of sending out how quickly certain jobs like cumulated indexes to Indian Science Abstracts, preparation of a roster of translators etc., can be done with the existing computer facilities in Delhi alongwith the preliminary hardware facilities like the sorter, puncher available at Insdoc itself. We should investigate how best we are going to do these conventional things with the unconventional machines. Most of these libraries which reported results on automation did not invest directly on a computer but utilized the computer facilities available nearby by buying time. Figures of 50000 vol. were obtained on a pragmatic experience in which certain amount of success was claimed. It is based on factual experience only.

Mr. Dhanpat Rai: How far can the smaller libraries utilise the "voracious appetite" of the computer in the light of that data (presented by him).

Mr. Phadnis: The Library of Congress with its huge organisation reported that it was not economical to use computers for the information retrieval operations.

The Chairman: An attempt is being made to discuss that whether we have enough work to feed the computer, and whether we can make tidy operations with it. This does not mean that every university library is going to have a computer and all operations are to be automated. We are going to discuss, as to how we utilise the neighbouring facilities to make our operations easier.

Mr. Dutta: The utilisation of computer facility can be compared to the utilization of atomic power. In the long run, these will become cheaper and worth attempting.

The Chairman: Kindly explain the concept of the adaptive information.

Mr. Kapur: We are using information; it has a value and everytime we adjust to see different alternatives. In this process we are indulging in multi-variable analysis. We are attempting to make the maximum use of the resources available. This is the motion, he said. The system is a hierarchical one and it has many a level. We have to change the values of decisions altogether, which means we are applying the concepts of the dynamic programming. The genuine user of documentation service requires certain amount of elasticity so that he can have a choice to adjust the problem later on. It is essential that the system should possess the possibilities to project the present status of engineering so that one can be more productive. In the existing IR systems e.g. statistical, empirical, we are interested to redo the same operation and as such the logic of the computer is not being utilised and we are not saving effort. From this point of view, unless we make use of classification system, since knowledge is growing at a faster rate, it becomes out of date. In the present system we are repeating operations in which there is no necessity of classification. Thus, in a dictionary type operation, we are repeating operations. Instead, we should have a system on which we dwell on topology or continuity of the knowledge. For this, we consider the conc concept of complete bibliography. A system of classification serves as an aid to simplify matters at the time of searching. Since a research worker cannot really conceive a consistent system to use classification system, a dynamic programming is required. The classification system should have a resolution to accommodate latest techniques and with the rate of generation of information becoming faster. We should have a perpetuating system. Since computers are increasingly being used for searching, it is not difficult to have a dynamic approach. Yet all these things are at the conceptual level.

The Chairman: What are the time and scope parameters?

Mr. Kapur: One of the parameters is when we collect bibliography, we can arrange the period so that we are not outdated.

Mr. Chakravarti: How this consensus can be collected. It is the choice of the person performing this work rather than the consensus of the literary community.

Mr. Misra: What is the cannotation Mr. Kapur had in mind for the expression "complete bibliography"?

Mr. Kapur: Ultimately it is believed those systems using topological approach are bound to be economical and are bound to result in optimisation of IR systems. By making the codes complex, we are making the machine to do the optimal work.

Mr. Vajifdar: Whether the bibliographic coupling referred by Mr. Kapur is the same as citation index?

Mr. Kapur: Yes.

Dr. Sharma: The bibliography should be oriented towards the needs of the user by proper selection of subject headings etc.

Mr. Dutta: Usually a research worker is interested in a narrow field and also he put a limitation on time period as to which he wants to cover. In this context, how can one explain the concept of complete bibliography?

Mr. Kapur: After defining the problem, he will proceed with codification as far as genetics is concerned then the chemical fiel etc. The narrow the field, the better it will have a well-defined distribution.

Mr. Haravu: Whether the adaptive information retrieval described by Mr. Kapur can be extended for a general use by many people instead of a personalised information system?

Mr. Kapur: The system described in his pape assumes a well defined user — the specialist. It is possible for a well-trained librarian, to carry out this work.

Mr. Raizada: Mr. Kapur has not completely followed Mr. Haravu's question. [He amplified the question].

Mr. Rajan: Since Mr. Kapur agreed that his concept of bibliographic coupling is akin to the citation index, it follows that it should be possible to extend this to general systems as the science citation index does.

Mr. Radhakrishnan: The adaptiveness should mean the capacity of self learning, similar to a child who on touching a hot bulb avoides it next time, learning in the process that the bulb will be hot. Whether this can be done by a computer? What sort of influence the system may have if topological concept is not utilised to optimise the system?

Mr. Kapur: So far as IR systems are concerned this sort of direct concept of adaptiveness visualised by Mr. Radhakrishnan will not work. The IR system, he maintained does not involve a simple decision, but it involves multivariate analysis. In a statistical search we are asking the machine only to reproduce what has been already fed into it. In a topological approach, the information content is searched also provides refinement of the search as needed by the user.

APPLICABILITY OF COMPUTER INSTALLATIONS IN INDIA FOR LIBRARY WORK

A S Raizada

Faster, cheaper and more versatile computers are being developed by the computer industry. Computers facilitate the processing of control and service information in a library and make the library service more effective and useful. The spare capacity on many computer facilities in India can be advantageously used for undertaking the feasibility study of processing the control information.

INTRODUCTION

Automatic computers were developed during the Second World War, but it was not until middle of fifties that these were commercially available. Since then, computer technology has made astounding progress. Faster, cheaper and more versatile computers are being developed by the computer industry. Alongwith this development, human ingenuity too has not been lagging. There is hardly any human activity left, where computers have not been used or are not being tried. The first industrial revolution saved man of physical labour and computers, by saving man of mental-routines, have begun the second industrial revolution. In fact, wherever there is any information to be processed, computers either exist or have potential of being existing. In this sense, it will not be too much to call computers as information handling machines or simply information machines.

LIBRARY

Library is a system or an organisation that handles 'information'. In this context, the term 'information' has a special significance. It stands for communicated facts or in other words published facts or data. Here, the terms, facts and data are considered as undefined. In a library, the information is processed before it can be handled. The processing of information may involve all conceivable operations on the information with the obvious exception of ignoring the information. It may mean recording, transmitting, memorising, abstracting, extracting, separating, sorting, merging, comparing, compiling, sequencing, presenting or even discarding. The characteristic feature of a library is that these operations are performed both on information and on the physical or material counterpart i.e. documents or books. From this point of view a typical library has both material flow as well as information flow.

TYPES OF INFORMATION

Broadly speaking, a library handles and processes two main categories of information. These may be termed as 'Managerial or Control' and 'Service' information. The Control Information is required for regulating the daily operations, for effecting high level control, for formulating right policies and for implementing these policies. This kind of information includes the information on budget, order and receipt of new books and periodicals, circulation, control, information etc. The Service Information pertains to the cataloguing, indexing, bibliographic activities. A Librarian or an Information Scientist needs both these types of information for managing a well run and efficient information service.

APPLICATION OF COMPUTER

In the Western countries computer has been reported to have been used for processing both these types of information. The results are that libraries are being managed, effectively with greater utilization of published information, and with faster service. While considering the computer applications, it may be indicated that irrespective of the nature of application involved, computers have been used in any of the following eight modes of operations:

1. Open-loop system.
1.1 Off-line directly coupled.
1.2 Off-line indirectly coupled.
1.3 On-line directly coupled.
1.4 On-line indirectly coupled.
2 Closed-loop system.
2.1 Off-line directly coupled.
2.2 Off-line indirectly coupled
2.3 On-line directly coupled
2.4 On-line indirectly coupled.

The concepts of on-line, off-line, direct and indirect coupling, is a matter of hardware configuration of the computer. Suffice is to say that the computer is 'on-line' if the input to it is unmediated by humans, it is off-line if the input to the computer is coded, punched, verified and fed by human agency. If the computer gives the processed information to the systems, or to users by means of transmission channels, it is the case of a directly coupled. Otherwise if the output is given by the way of listing or reports etc. that has to be mailed or delivered to the users the computer is said to be indirectly coupled.

For the purposes of information service, the computer has been mostly used as an open-loop system both in off-line as well as on-line mode.

COMPUTER FACILITIES IN INDIA

Computers appeared on the Indian scene in the middle of the present decade, in rather a big way. In fact, the computer age in India started with the establishment of the computer Centre at Indian Institute of Technology, Kanpur during the close of 1963 and the beginning of 1964. There are about 120 computers installed in about 106 organisations scattered in about 24 towns all over India. There is a concentration of these in cities like Calcutta, Bombay, Delhi, Bangalore having 23, 28, 15, and 8 computers respectively. There are about 20 computers installed at universities and other research institutions. Most of these computers are functioning in off-line and indirectly coupled mode of operation.

TYPES OF COMPUTERS

The Table given in the annexure presents an analysis of available computer facilities in India. The table is based on the data available with the Computer Society of India. It is interesting to note that nearly half of the installations are small-size, business-oriented, second generation computers. There are only two large size second generation computers available in the country. These are at Bombay and Kanpur. As many as four third generation computers are being planned to be installed in the country. This analysis is based on the data-available at the Computer Society of India.

FACILITY AT DELHI

At Delhi there are six IBM 1401 installed at S. B. Mills, Northern Railway Headquarters, Railway Board, Registrar General of Census, IBM Service Bureau, and Indian Airlines. Most of these have a 8 K memory, four tape drives, card read and punch, and an on-line printer. There are four IBM 1620, three of these are model II and only one is model I. All the model II have a 40 K memory, three disk drives, a card read punch and ~~on~~ on-line printer. In addition to these, there are five Honeywell 400 installed at the Government Computer Centre and at Joint Cipher Bureau. Apart from these, there is an Elliot-803 installed at the Telecommunication Research Centre.

SUITABILITY REQUIREMENT

In India computermation of library and documentation operation started during 1964 [1]. Since then quite a few isolated operation and services have been computerised [2, 3]. The suitability requirements that are being presented here are based on experience gained during the past five years.

COMPUTER

The library information is expressed mostly in alphabetical form. The processing of the information in a library involves the handling of large mass of data or large information files. This requires cheap storage facilities, fast access to the stored information, fast input/output devices and medium size core memory. This implies that the computer facility should have on-line magnetic stores either as magnetic tapes or disks. A combination of both is to be preferred, on account of the compact storage on tape and fast access on disk. Without the external on-line memory, a computer facility is of no avail in the processing of either the control or the service information. The computer facilities should preferably have a card input device. A fast on-line printer is the output requisite for any computer facility, if it is going to be useful in library operations. All these considerations are based on the fact that the library applications of computer involves a large amount of data input, few processing operations like comparisons, transfers, selections etc. and fairly large output as opposed to computational applications where the input is small, processing is large and the output is small.

Since the configurational details of all the computer installations in India are not available, it is difficult to enumerate all those facilities that are suitable for library operations. However, the facilities satisfying the above mentioned criteria are suitable for library operations. Some of these are, IBM 1620's installations at CMERI, Durgapur; DSE, IARS, & PEO, at Delhi; CDC-3600 at TIFR, Bombay; IBM 1401 and 7044 at Kanpur; IBM 1401 at S. B. Mills and Registrar General's Office at Delhi; ISI, Calcutta; and ICL 1903 at HMT, Bangalore etc. This list of installations is based on personal knowledge and is not exhaustive.

AVAILABILITY AND ACCESSIBILITY

The other group of factors determining the suitability of the computer facilities belong to the availability and accessibility of the computer. This gains a fair degree of importance in the absence of 'on-line' directly coupled computer facilities in India. Certain facilities may be available for library use, but may not be easily accessible and vice-versa. Since the nature of library operations requires both availability and accessibility, that as far as possible the requisite facility should be available on the campus. In this context some of the computer facilities installed at IIT, Kanpur; DSE, Delhi; TIFR, Bombay; CMERI, Durgapur; ISI Calcutta are ideally suited for exploratory studies in computerizing library operations. However, the libraries in the private-sector may benefit by using spare capacity on computer facilities installed in their organisations provided the facility meets the configurational requirements.

COST

Last but not the least, is the cost factor. As a matter of fact, in India, the major delaying factor in experimenting with the computers has been the cost which is being considered rather prohibitive. It will be worthwhile to examine it in some detail.

The cost of computerisation includes the following:

1. Information Preparation Cost:
2. Programming Cost; and
3. Machine Cost.

1. Information Preparation Cost

In the absence of on-line facility for reading library texts all the information that has to be processed by the computer must be coded, punched and verified. The punching may be of cards or of tapes. Apart from the low speeds, the preparation cost is fairly high. Most of the service bureaux charge at the rate of Rs.150/- to Rs.250/- per thousand punched cards. However, at some of the computer installations, the punching facility is included in the computer rental. Further this cost can be shared by a group of similar libraries as most of the information that is to be processed may eventually turn out to be common. These libraries may then use the disk or tape files which are comparatively cheaper to copy.

2. Programming Cost

The major share of the total of the computerization goes to the programming. One government organisation charges for programming at the rate of Rs. 1,000/- per programmer month. It must be stated that the time required for programming a problem is the most difficult to ascertain and no norms exist for estimating it. The time needed for developing a programme is a function of the experience of a programmer, clear and unambiguous formulation of the problem, and the nature of the problem itself. However, this cost can be brought down by sharing programming cost in a joint project. In such an event the libraries having an access to similar type of computer facility may cooperate with each other. The other method of reducing the programming cost is to buy the tested programmes. The purchasing of these programmes have drawbacks of introducing rigidity in solving a problem arising out of local variations. Programming cost has to be considered as one time investment.

3. Machine Cost

Includes the rental of the machine for the time used. The time of use may include the testing and debugging runs of the programmes and the final runs. Most of the academic and research computers offer their facilities at an hourly rate varying from Rs. 190/- to 600/- per hour depending on the system.

INSDOC'S EXPERIENCE

An attempt was made at Insdoc to find out the cost of indexing by computer. The figures are as follows:

a)	Punching and Verification of about 2,500 cards per month needing 60 man-hours.	Rs. 160.00
	Cost of the cards	Rs. 60.00
		Rs. 220.00

b)	Author Index	Computer time
1.	Input at the speed of 500 cards per mt.	1.5 mts.
2.	Sorting 1,500 names	2 mts.
3.	Sequencing 1,500 names	2 mts.
4.	Index printing of 1,500 names at the speed of 250 lines/mt.	6 mts.
	Total time:	11.5 mts. = 12 mt.
5.	Cost of the computer time at the rate of Rs. 3/- per mt. i.e.	Rs. 36/-

c)	Key world Index	Computer time
1.	Input at the speed of 450 card per mt.	4 mts.
2.	Sorting 2,000 terms	5 mts.
3.	Sequencing 2,000 terms	15 mts.
4.	Index printing of 2,000 lines at the rate of 200 lines per mt.	0 mts.
	Total time:	34 mts.

5. The cost of the computer time at the rate of Rs. 3/- per minute is Rs. 102/- approx.

The computerised preparation of the monthly indexes to the Indian Science Abstracts costs Insdoc about Rs. 350/- or Rs. 400/- in round figures.

The annual cumulation of these indexes takes about 8 computer hours and cost about Rs. 1,500/- at the rate of Rs. 190/- per hour.

Programming cost came to about Rs. 3,000/- for these jobs.

The cost analysis of the compilation of the Mysore fascicule of the Union Catalogue is being undertaken and will be reported later.

CONCLUSION

It is concluded that:

1. Computers facilitate the processing of control and service information in a library and make the library service more effective and useful.

2. There is a sufficient spare capacity on many computer facilities which are suitable for this type of work on an off-line use.

3. It will be advantageous to use this spare capacity for undertaking the feasibility study of processing the control information by computers.

4. In order to utilise this facility there is a need for libraries to have a suitable person trained on the use of computers. This training must have a orientation different from that of computational applications of a computer.

5. In order to cut down the costs, it is essential that these studies should be undertaken on co-operative basis and as joint projects by a group of libraries.

6. These feasibility studies should include studies to ascertain the extent of quantitative and qualitative improvements in the management and services of the libraries participating in such joint project.

7. It will be extremely useful if in this Seminar some areas for experimental computerisation are identified alongwith the participation of joint projects.

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[3] HARAVU L J, RAIZADA A S: Computerized Data Retrieval: An Experiment with IBM 1620. Ann Lib Sci & Docum 1967, 14(2), 76-88

ANNEXURE

Model Make	International Business Machines Corporation								International Computers Ltd.,															
Location	360/44	1130	1401	1410	1440	1460	1620	7044	1004	1202	1300	1900	1901	1902	1903	1904	1905	S	HW	E	M	CDC	I	H	
Bombay			13	1		2	1		3		2	1							2		1	1			27
Calcuttal		1	11		1				3	1	1				1	1			1				1	1	23
Delhi			6				4										1		4	1					16
Bangalore	1				1						1				1			1	1	2					8
Madras		1	3				1				1														6
Poona							1		1					1	1				1						5
Ahmedabad			2				2																		4
Hyderabad			2				2																		4
Jamshedpur			4																						4
Varanasi			2																						2
Durgapur			1				1																		2
Kanpur			1				1	1																	3
Bhilai			1																						1
Rourkela			1																						1
Bhopal									1																1
Chandigarh							1																		1
Kharagpur							1																		1
Roorkee							1																		1
Dehradun																			1						1
Digboi													1												1
Baroda			1								1														2
Nizamabad			1																						1
Trivandrum																					1				1
Hooghly			1																						1
TOTAL	1	2	50	1	2	2	16	1	8	1	6	1	1	1	3	1	1	1	10	3	2	1	1	1	117

S = SIRIUS HW = HONEY WELL E = ELLIOT M = MINSKII CDC = CDC I = ISIJU HEC = HEC

DISCUSSION

Mr. Misra: I have a report entitled "Computer facilities and services in India - an evaluation" based on a survey conducted by Mr. Lynn P. Madden, CMERI. This supplements Mr. Raizada's paper. Interested persons may have a copy.

Mr. Srinivasan: CBRI has a computer called IBM 1620. The library has not made use of it, because they do not know how to make use of it. He suggested that INSDOC should give training to them as it has acquired sufficient knowledge about the computer usage.

Dr. Sharma: Has Mr. Raizada mentioned about a computer stationed in Chandigarh? How many of us do know or have seen a computer?

Mr. Raizada: The computer at Chandigarh has been included in the paper. It is difficult to answer second question with precision. However, I assume that there is a sizable number of librarians in India who have at least seen a computer.

Dr. Thakore: Regarding the last question of Dr. Sharma about 5% are using the computer. It is a problem of the country, but there are institutes/societies, which are hardly using them, even if they are having computer.

Mr. Vij: We do not have the men and the money to give the training. I propose a resolution that there should be training, given by the universities, on the use of computers.

Mr. Malwad: For information of the house BARC has some reports on the use of computer. To use a computer one needs to know programming, which is intellectual, whether the problem is routine or not. The training should be included in the library science courses, and INSDOC should send a sample syllabus to universities for training purposes.

Dr. Nag: The training on the application of computer in library science is necessary. The Jadavpur University, Calcutta has taken in view of this training programme and they have adopted this in the post-graduate course in library science. Half of the paper in Information Retrieval is on the "list processing system". And this training programme is both academic and practical. It is possible for other universities and institutions to undertake similar programme in their academic curriculum.

Mr. Kapur: I wish to present my observation on training as follows: 1) Fundamental change in the curriculum of the library science training is necessary; 2) General analysis in the training is vital, because rudiment of classification etc. is not sufficient; 3) Refreshers' courses can be arranged and it is possible for INSDOC to do it; 4) In the beginning some semi-mechanic system like punched card etc. may be introduced to make us computer-minded. Before publishing, the programmes they should be made normal and standard; 5) Even simple computer may derive good results in comparison to other good computer. Hybrid - Analogue Computer can be used for library purposes; and 6) Mass education can be arranged on a regional basis.

Dr. Nag: How do you envisage that analogue computer can be used in place of digital computer?

Mr. Kapur: There are digitizers, which might be used for converting analogue computer into digital computer. Of course we are to develop it.

Mr. Chakraborty: Mr. Raizada's paper is an excellent paper but there is one lacunae, that is, he has not stated as to how to find out what type of computer is suitable for what type of operation.

Mr. Raizada: There are no ready made tests available. However this particular application requires large on-line memory, fast medium size core storage and fast through put device. The test has to be developed by us.

DISCUSSION

Mr. Mangla: Computer is a machine-logically devised, can it be successfully used for all library operations? The library science courses of Delhi University, have not introduced it. That is not necessary as yet. What type of people are necessary for doing this kind of job? Those who know about the computer operations have not made other to know about it. Some reports from those, who are working with it are needed.

Mr. Raizada: Computers have been selectively used for library operations in many countries. It is true that there is not a single library which is completely computerized, but many routines and services have been computerized. The major benefits of computerisation are the accurate execution of routines and the availability of more man hours for professional and personalised services which are otherwise consumed by these routines. I feel that the subject should be introduced in university curricula both at graduate and post-graduate level. In the present moment, Osterich like policy will not be of much avail.. Reports of experiences with computerization are appearing in the professional journals. Insdoc's experiences in this field are published in 'Annals of Library Science and Documentation' from time to time.

Dr. Nag: Has any feasibility study been made on the applicability of computer to library operations?

Mr. Raizada: No, not so far as I know. I am working only with the IBM 1620 II. I can talk about it. However, I would like to have the experience of those who have worked with different types of computers.

Dr. Nag: For example how many tapes are needed?

Mr. Raizada: We are using Disk packs and we often find that three drives are not enough. At Kanpur three tape drives on 1620 were not enough for sorting and dictionary look ups.

Mr. Rajan: Literature is lacking on the analysis of working with the manual method.

Mr. Biswas: Why in India we are using routine job for computerization? INSDOC should under take a feasibility study.

Mr. Chairman: Mr. Khandekar's opinion about the training courses in programming will be of benefit to house. I request him to give us his experience.

Mr. Khandekar: There are about 3 to 4 programming courses in Delhi School of Economics. Besides there are refreshers' courses. I suggest that these types of courses INSDOC can also organise, who sometimes back had organised one course.

Mr. Chairman: I invite Mr. Malwad to tell about his experiences.

Mr. Malwad: I worked with CDC 3600 computer, which is a fixed word length computer. Prof. Narasimhan gave the problem to compile KWIC index for the reports available at BARC. Technical reports at BARC are arranged according to serial numbers. Throughout the country subject-wise enquiries come for all these reports. To solve this problem they had to do tremendous work. A Sort-Merge Programme was developed for this purpose, which appeared to be costly. So they took the help of CDC's Sort-Merge Programme.

While reading cards the programme will take Keyword out of the title then create a file with Keyword + Title + Serial number. Insignificant Keywords are dropped out. For searching they refer this file on magnetic tape. Finally they alphabetise the Keywords and print in lists and then sent to different divisions of BARC.

They donot claim to be the first to solve this problem in India, but surely one of them.

Mr. Radhakrishnan: On the request of Mr. Raizada, I wish to add that at IIT, we use IBM 7044. It is a word organised machine, general-purpose, with its capabilities and limitations. I will give in details in a different session of this seminar.

Mr. Bhardwaj: Libraries should adopt the services of computers and get introduced to computers, because it is needed.

Mr. Chairman: Librarians who liked to go for automation should provide for the training of the library staff. Depending on the type of work we have, we are to choose the type of computer. Of course, as Mr. Kapur said, it can be modified for the purpose. Some research on the application of computer in library work should be conducted. A systematic study is necessary as there is not much work on it has been reported.

COMPUTERISED COMPILATION OF UNION CATALOGUE

A S Raizada
N C Khandekar
S N Sur

Describes the experiment on the computerized processing of the Union Catalogue of periodical publication. Analyses the concepts of the periodical publication and the Union Catalogue. Gives the details of phases of the programming system 'Consol' which processes the data for the Union Catalogue of Mysore State. The card designs for various input files are also presented.

INTRODUCTION

Any information or documentation service frequently needs to know the availability of information-sources. As an information-source the periodical publication or journal is perhaps the most important. The union catalogue is a device, for indicating the availability of a particular periodical in various libraries. Insdoc started the collection of information for the compilation of the National Union Catalogue during 1958. In 1964, the first Indian experiment on computer application for the library operation was designed and conducted on IBM 1620 at IIT, Kanpur. The results of this, have already been published [1]. The present paper describes another experiment on computerised compilation of union catalogue.

PERIODICAL PUBLICATION

It is essential to highlight some of the features of a periodical publication. A periodical publication is a major information-source of research results. It has self-contained units of scientific ideas and these ideas are often not related to each other like that of the chapters of a Book or a Monograph. Further, a periodical is a continued publication intended to be published at a regular time interval. Each issue of the same periodical differs from the other with respect to the thought content and the authorship. It is only the name of the periodical which binds the various issues of a periodical together. The use of a periodical publication differs from that of abook. A periodical is seldom read from cover to cover like a book. The current periodical or the latest issue of a journal is generally scanned from cover to cover with the sole view of finding any information item of interest and it is this item that is studied. The old issues of periodicals are not even scanned. These are referred to for a particular item of information whose identification details are already available with the enquirer. The number of periodicals published in the World is estimated between 60 to 100 thousands.

UNION CATALOGUE

The over-all economic considerations demand that each and every title need not be subscribed by every library and that this material should be made available to the entire community irrespective of the ownership. This concept presupposes the availability list of all the periodicals in a geographical region. These availability lists are called union catalogues in library parlance. The mian purpose of the union catalogue is to indicate the libraries where the specific issue of a particular periodical is available. The union catalogue is supposed to have some other functions as well, like serving as a tool for cooperative acquisition programme of a group of libraries, for indicating lacuna in the collection of periodicals in a region and for tracing the life history of a periodical, or even correcting an incomplete or incorrect title which is being searched. These extra functions can be provided in a union catalogue but at a considerable effort at the stages of information collection, editing, and processing operations in the compilation. These requirements need separate location tools by way of indices. They also increase the compilation, processing and production costs and time at the expense of the main function of the union catalogue.

Structure

Conventionally a union catalogue is arranged alphabetically by the names of the titles of periodicals with subject, geographic language or sponsor indexes. Some union catalogues are arranged according to a chosen scheme of library classification. This arrangement demands co-extensive class numbers and indexes like alphabetical title index, geographical index, alphabetical subject index etc. Irrespective of the arrangement, all the information pertaining to a title is commonly referred to as a main entry.

MAIN ENTRY

A main entry in a union catalogue, providing complete information about a periodical consists of discrete items of information with their sequence, more or less fixed. These items of information are full title, alternative names including abbreviated form, initionym etc., sponsoring body, if any, place of publication, the date of commencement, life history of the periodical, library symbols along with their holdings and the information on the gaps or incomplete volumes in the holding.

COMPUTER-AIDED COMPILATION

The purpose of the present experiment is to investigate the possibility of IBM 1620 Model II using a computer for use in the compilation and processing of the state fascicules of the National Union Catalogue of scientific and technical periodicals. The experiment also aims in acquiring some experience on the techniques of generating and manipulating such large information files.

COMPUTER FACILITY

The computer facility available to Insdoc is the hardware configuration installed at the Computer Centre, Delhi School of Economics, Delhi. It has an IBM 1620 Model II data processing system having a 40 K core memory. There are three 1311 disk drives, one 1443 on-line printer and one 1622 card read punch. At Insdoc there is one 029 print-cum-punch, one 056 verifier, one 024 punch and one 082 sorter. In addition to this Insdoc has acquired ten 1316 disk packs.

RAW DATA

The information for this experiment includes the titles of some 7,000 periodicals available in about 89 libraries in the Mysore State since 1965. This mass of data has been taken from the printed catalogues of the Indian Institute of Science, Union Catalogue of Bangalore city excluding the Indian Institute of Science, and the union catalogue of Mysore State sans the Bangalore town.

REPARATION OF SOURCE DATA

There are five card-designs involved in the preparation of the data for computerised processing which are presented in the table on the next page.

The data preparation involves coding, punching and verification. All the data were transcribed on coding sheets. Nearly eighty thousand cards were punched and verified.

COMPUTER OPERATIONS

The union catalogue of Mysore regions has been processed by IBM 1620 Model II in five phases. These are: Generation phase, Correction phase, Updating phase, Consolidation phase and Indexing phase. CONSOL is the name given to the programming system which executes all these phases. Approximately thirty programmes have been written for CONSOL in SPS IID programming language. The details of CONSOL will be published later. However, the function of each phase is briefly presented here.

Generation Phase

In this phase the punched cards are read in the computer and four disk files are created. These files are called Control, Title, Holdings and Code dictionary files. In all these files the control and the restart information is available at the last sector of each pack. Further, the information is stored in a different format on the disk with a view to the maximum utilization of the disk storage capa-

CARD DESIGN

Type	Col. No.	Type of information	Mode
1 (Control file)	1-5	Periodical No.	Numeric
	6-9	Class code	Mixed
	10-15	Sponsor code	Numeric
	*16-25	Subject code	Mixed
	26-33	Place code	Mixed
	34-79	Standard Abbreviated title	Mixed
	80	Type of card No.	Numeric

* If subject code no. is not accommodated in these columns then another card is coded with the following information.

Type	Col. No.	Type of information	Mode
	1-5	Periodical No.	Numeric
	6-15	Overflowing portion of the subject code	Mixed
	80	Type of card No.	Numeric
2 (Title)	1-5	Periodical No.	Numeric
	6	Continued card No. (maximum of ten cards are allowed)	Numeric
	7-78	Title of the serials	Mixed
	79	Continuation No.	Numeric
	80	Type of card No.	Numeric
3 (Sponsor)	1-5	Periodical No.	Numeric
	6	Continued card No. (It continues with card type 2)	Numeric
	7-78	Name of the sponsor	Alphameric
	79	Continuation No.	Numeric
	80	Type of card No.	Numeric
4 (Place, Volume & Date)	1-5	Periodical No.	Numeric
	6	Continued card No. (It continues with card type 2 & 3)	Numeric
	7-25	Name of Place	Alphameric
	26-28	Vol (If the volume No. is missing from a periodical, then Vol. is not coded)	Alphameric
	29-78	First vol. No. and the year of start	Mixed
	79	If sponsor is missing from a periodical then 3 is coded here otherwise blank	-
	80	Type of card No.	Numeric
5 (Holdings)	1-5	Periodical No.	Numeric
	6	Blank	-
	7-10	Library code	Numeric
	11-16	Library symbol	Alphameric
	17-79	Holding	Mixed
	80	Type of card No.	Numeric

city. Some ten programmes have been written in SPS language for this phase. Basically these programmes read information from cards, check the type of the card, give out error messages, and store the information in the appropriate files in the desired format. It must be stated that the control cards, title cards inclusive of types 2, 3 & 4, holdings cards, and dictionary cards are fed separately. The creation of control, title, holdings and dictionary files are separate computer operations. At the creation stage in the generation phase there is also a provision of obtaining sample listings from different parts of the pack to ensure that the data have been correctly stored in each of the files.

Correction Phase

In this phase there is a provision of getting the entire files printed in any order, to find out the errors by visually checking the print outs of these files. The detected errors can be directly corrected on the disk packs without reading all the cards again. This enhance the accuracy of the data. After this phase, normally the title and holdings files are frozen. Nearly six programmes have been written for this phase.

Updating Phase

This phase takes care of eliminating duplicate entries of the same title. This may be done either by using the control file or by using the title file. In the present case, the title file was used. Firstly a condensed title file was obtained by eliminating all spaces, punctuation marks, and insignificant words in a title. This condensed file was sequenced alphabetically and duplicates isolated. The appropriate corrections were carried out on the condensed file, Holdings file and control file. This phase has three programmes.

Consolidation Phase

In this phase the control information from the condensed (Alpha file) is extracted and stored on a pack. The consolidation is executed with three packs mounted on three available drives. The periodical number is obtained from the extracted file, the corresponding record from the title file is called in the core along with the corresponding record from the holdings file. Thus the consolidated record for each of the titles is made available. This consolidated record is edited according to the format specification for the printing of the catalogue. This phase gives a single column continuous print out which can be made into pages and printed by photo-offset method. This phase requires only one programme consisting of three large and complicated subroutines.

Indexing Phase

This phase sorts the control file on the desired code field. It produces the indexes along with the appropriate headings. This phase requires four programmes.

PROGRESS OF CONSOL

The Generation, Correction and the Updating phase of the CONSOL has been completed. The consolidation phase is in testing stage and it will be completed in the near future. The programs for indexing phase are being written and have to be tested before the last phase in the computerised processing of this experimental fascicule can be completed.

OPERATIONAL DATA ON CONSOL

The operational data on consol like the work load, the performance time and cost etc. is being gathered and analysed. The results will be published later.

BY-PRODUCTS

As a result of the computer processing of the Mysore Fascicule of the National Union Catalogue, it will be possible to produce and distribute individual Library Catalogues. This, it is hoped, will facilitate the updating of holdings records of individual libraries to be made available at the time of compilation of the National Union Catalogue. The data stored on the disk pack is amenable for statistical analysis from various view points. These analyses can be made available for formulating and correcting the acquisition programme of periodical publications at various levels with a view to maximise the exploitation of this type of literature, quickly and at a cheaper processing cost than would otherwise have been possible.

CONCLUSION

On the basis of the experience gained so far it can be concluded that:

1. It is possible to produce union catalogue on the available computer facility.

2. The programming system CONSOL has been developed to produce the union catalogue of Mysore State. The same system can be used for producing the state fascicules of union catalogue for other states. Universities can use this system for producing their union catalogue of all the departmental and main library collection.

3. It will be faster to produce further series of union catalogue through a computer using CONSOL, directly from the data-gathering slips.

4. There is need for rethinking on the inclusion of all the elements that are included only because of tradition, in the manually processed union catalogue.

5. This need assumes sizeable proportions in terms of cost and human effort for the processing of the National Union Catalogue. The rethinking is necessary if it is desired to utilise the union catalogue files on disk packs for computerised document procurement work, in the near future.

ACKNOWLEDGEMENT

The authors are grateful to Shri B.S. Kesavan not only for providing all the necessary facilities and encouragement of work but also for giving an opportunity for sharing their ignorance, misgivings and doubts with experts in the librarianship and computer science. They are also thankful to the Management Committee of the Computer Centre, Delhi School of Economics for their kind permission of using the computer beyond the normal working hours.

REFERENCE

[1] RAIZADA A S: Automation in Documentation. Union Catalouge Processing by Digital Computers. Ann Lib Sci & Docum 1964, 11(4), 54-76.

DISCUSSION

The Chairman: I request Mr. Raizada to give us an account of the work load involved.

Mr. Raizada: The source information is the printed catalogues of the Indian Institute of Science, the Regional Union Catalogue of Bangalore Sans the IIS Catalogue and the Union Catalogue of Mysore Sans the Bangalore Region. The information in these catalogues is first coded onto coding sheets and later about 80,000 cards had to be punched and verified. The testing and trial run of the various programmes had taken about 40 computer hours. He felt that it would take another 10 hours to produce the computer print-out of the fasicule.

The Chairman: What are the views of the authors in regard to the inclusion or exclusion of certain categories of information in the computer produced version of the Union Catalogue vis-a-vis the traditionally produced Union Catalogue.

Mr. Raizada: The back dated journals are used only when the user had a reference to a specific article/paper in the back dated journal. This he usually gets from a secondary source. The title of the periodical got from the secondary source would be the one that was current at the time it was published. As such, giving the evolutionary or historical data of the periodical would in no way reduce the utility of a Union Catalogue in serving its primary function as a location tool. Further the frequency and need for tracing the life history of a periodical in service libraries was negligible. As such, adding this additional information to an Union Catalogue will increase its bulk and consequently reduce its utility and handling ease.

Dr. Vajifdar: What is the opinion of the authors about the inclusion or exclusion of the information about sponsors in the Union Catalogue?

Mr. Raizada: The approach to the Union Catalogue is predominantly title based and as such there may not be need to provide an approach from the point of view of sponsors.

The Chairman: I request Mr. Dutta, of the Union Catalogue Project of Insdoc to tell the house his view of the compilation, form and content of the Union Catalogue.

Mr. Dutta: Insdoc has already covered about 141 libraries in the country. The object was to compile Regional Catalogues first. In regard to the content of the Union Catalogues, they are guided by the practice followed by the National Union Catalogue of other countries. He felt that a National Union Catalogue should provide the evolutionary information about periodicals for several reasons. One of the reasons is that without such information it was difficult for a national body to estimate the lacunae in the periodical collections of a nation. The computer should be able to continously cumulate the Regional Catalogues to produce a National Union Catalogue.

COMPUTERISED ACQUISITION ROUTINES OF SERIALS

L J Haravu

Gives an account of the experiment on the computerization of acquisition routines of periodical publication in a library. Describes the generation of necessary files and their manipulation. The experiment has been successful within the limitations. Indicates the area of further work.

INTRODUCTION

Stated very succintly, the periodicals department of any University or special library is primarily concerned with ensuring that the journals selected for acquisition are ordered/renewed, and paid for in time; that they are received regularly and on time; that they are routed/displayed or brought to the notice of the library's clientele on time; and finally that they are bound or stored properly so that they are available at call when needed. The underlying fact behind all these jobs is that they are time barred. The time interval between the same operation being done twice varies with the nature of the operation, nevertheless timely action is of the essence in the periodicals section of the library. The decision as to the procedure to be adopted, the routines to be followed and the equipment to be used in order that timely action is taken is what Periodicals Control is concerned with.

APPROACHES TO COMPUTERIZATION

The possible approaches to the use of computers in periodicals control are: 1) the design of a computerised system to cover the totality of operations, tasks and jobs in the periodicals department i. e. from the order/payment-checking including in acquisition list-providing routing information-sending overdue reminders - printing of list-budgeting and costing-updating of holdings list to the last detail of giving very specific instructions to the binder. In this approach human intervention is very marginal; 2) alternatively a system may be designed where some of the operations are delegated to the computer and the rest left to humans. The first approach is possible when the library has an on-line terminal coupled to a computer system in the university. With such an configuration it is possible to have on tape all the information required for day-to-day work in the section. The latter approach is possible when the library has access off-line to a computer system in the University. In such a case data is prepared off-line and fed to the system at regular intervals for processing.

The decision as to the choice depends also on other factors; an important one being whether it is possible or desireable to provide all the alternatives a prior to the computer for it to take the right decisions. Some of the jobs in the periodicals department are dependent heavily on the publication schedules and other pressures that operate on hundreds of publishers. The vagaries of such publication are only too well known to librarians.

THE EXPERIMENT

The experiment has included only 85 periodicals selected on the basis of subject, frequency, and country of origin. Three vendors have been assumed: One for American and Canadian periodicals; one for British and Continental journals, and one for Indian journals. Dailies have been excluded from the scope of this experiment.

The experiment also assumes that the checking-in or registration of the receipt of a periodical will remain a manual process. For the purpose of this experiment a year is divided into 24 fortnights, starting from fortnight No. 01 for the first fortnight of January to fortnight No. 24 for the last fortnight in December. The frequency Code of a periodical is a function of the frequency code for a fortnightly, which is 01. Thus the code for a monthly is 02 (month = 2 fortnights), a bimonthly is 04, etc. The fortnight No. is one of the inputs to the update-reminder routine discussed below. Each title is given a unique serial number.

In this study the following operations have been computerised:

1. Production of Renewal Lists;
2. Sending of overdue Claims;
3. Production of fortnightly lists of periodicals received in the library;
4. Provision has been made for special runs to isolate:
    (a) difficult cases - for instance, when a periodical has not been received at all or when there are too many gaps in the receipt of a periodical;
    (b) journals which have been received in full and are ready for binding.

The experiment is discussed in detail below:

File Generation

The first job to be done was the generation of a Master file of currently received periodicals. For this purpose, the following details have been included in the basic record of a periodical:

1. Serial No.: This is a 4 digited numeral given at the time of generating the file on cards.
2. Subject Code: The U.D.C. has been used for this purpose.
3. Publisher Code: A purely enumerative code has been used.
4. Frequency Code: A two digit code discussed above.
5. Vendor Code: An enumerative code.
6. Country code: An enumerative code.
7. Type of Acquisition: Different codes have been provided for subscription, gift, exchange, membership.
8. No. of issues expected in a year: Two digited number (actual).
9. Vol. No. at commencement: 4 digit number (actual).
10. Title in full.

The above catagories of information for each periodical were first coded on sheets and then punched on to cards for input to the computer.

The basic record on cards were then read and stored on the disk. At the time of the generation of the disk file certain areas on each record were demarcated as areas to be up-dated as and when periodicals were received in the library.

Another file of publishers and their addresses was also generated on disk. This contained the code for each publisher along with the full address of the publisher.

Production of lists

Once the basic records of periodicals are available on disk, this could be used to produce a variety of lists. A program has been written that can produce seven different kinds of lists. The options available are: (a) Alphabetical by title; (b) Subject; (c) Country; (d) Publisher; (e) Frequency; (f) Vendor; and (g) Type of Acquisition. The user specifies the option desired, followed by the dictionary of codes used for the specified option to get the desired listing. A sample of the alphabetical, subject and vendor lists have been presented in the annexure.

Update and Reminder Routine

The experiment has assumed a fortnightly rythm for the updating of the Master File and for the sending of reminders for overdue issues. A fortnightly rythm for the sending of overdue claims was considered sufficient, since most publishers consent to replace issues if intimated within six to eight weeks of their expected date of arrival.

In its operation, the experiment assumes that as and when an issue of a periodical is received, a card is punched giving the serial No., and Vol. No. and the Issue Nos. received. All cards for issues received during a fortnight form the input to this routine. This program updates the information concerning the last issue received and the expected fortnight of arrival of the next issue. The fortnight when the next issue is expected is computed by adding the current fortnight to the frequency of the periodical. When a periodical expected during the fortnight has not been received an overdue claim is printed. The claim contains the full address of the publisher, a letter and the particular volume and issue which is now overdue. A record is kept of the reminder sent. The program also updates the total number of issues received, as of the latest run with a view of producing binding lists when volumes get complete.

This routine also takes care of gaps in the receipt of periodicals and prints attention lists. These lists could be used for special manual action by the Librarian. A routine reminder may not always produce results, whereas a letter to the Head of the Subscription Department might result in the claim being specially attended to. It was with this in view that manual intervention for different cases was provided.

Printing of Fortnightly lists

As a by-product of the Update and Reminder routine, an alphabetical list of periodicals received during the fortnight is printed. An entry contains the full title, followed by Volume and Issue No. received. Such a list could be circulated after appropriate duplication.

LIMITATIONS

1. One of the obvious limitations is that it has covered only 85 periodicals.
2. No checking feature has been provided to ensure accuracy, that is when a periodical is received, it is assumed that the operator correctly records the serial No. etc. for it to be punched.
3. For each run of the update routine the Master file is updated. It would be more desireable to generate a duplicate updated file, so that at least one file is available in the event of wrong or faulty updating.
4. Information regarding price of the journal, the budget-head to be charged has not been provided.
5. The set of programmes have still to be tried in an actual working situation on larger data.
6. No provision has been made for automatic generation, updating and printing of holdings lists.

CONCLUSION

1. The limitations mentioned above indicate future work necessary in this area of library operation.
2. The use of computers in periodicals control would almost certainly take away the tears of ensuring that timely action is taken on renewal/reminders. There is no scope for any oversight as is always possible in manual systems.
3. Insdoc, with its existing facilities and its file of currently received periodicals could provide the necessary incentive for further experimentation in a joint project.

ACKNOWLEDGEMENT

The author is greatly indebted to Mr. B.S. Kesavan, Director, INSDOC, for providing the computer facilities and to Mr. S. Parthasarathy for their invaluable guidance and to my colleague Mr. S. Hasan for helping me in compiling the raw data.

ANNEXURE

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AMERICAL JOURNAL OF PHYSICS
AMERICAN MATHEMATICAL MONTHLY
ANALYTICA CHIMICA ACTA
ANNALS OF MATHEMATICAL STATISTICS
APPLIED OPTICS
ANTICORROSION METHODS AND MATERIALS
ARCHIVES OF BIOCHEMISTRY AND BIOPHYSICS
AUSTRALIAN JOURNAL OF PHYSICS
AUTOMATION AND REMOTE CONTROL
BELL SYSTEM TECHNICAL JOURNAL
BIOTECHNOLOGY AND BIOENGINEERING
BRITISH INTERNAL COMBUSTION ENGINE RES INST ABSTRACTS
BRITISH JOURNAL OF APPLIEDPHYSICS
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[Sample Alphabetical List]

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539.1             NUCLEAR PHYSICS

NUCLEAR INSTRUMENTS AND METHODS
NUCLEAR PHYSICS
NUCLEAR SCIENCE ABSTRACTS


539.3             PHYSICS OF SOLIDS

JOURNAL OF PHYSICS AND CHEMISTRY OF SOLIDS
PHYSICA STATUS SOLIDI
SOVIET PHYSICS SOLID STATE


54                CHEMISTRY

BULLETIN DE LA SOCIETE CHIMIQUE DE FRANCE
INDIAN JOURNAL OF CHEMISTRY


541.1             PHYSICAL CHEMISTRY

RUSSIAN JOURNAL OF PHYSICAL CHEMISTRY


543               ANALYTICAL CHEMISTRY

ANALYTICA CHIMICA ACTA


546               INORGANIC CHEMISTRY

INORGANIC AND NUCLEAR CHEMISTRY LETTERS
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[Sample Classified List]

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SUBSCRIPTIONS LTD.,7,JOURNAL STREET,LONDON W.1

AERONAUTICAL QUARTERLY
ANTICORROSION METHODS AND MATERIALS
AUSTRALIAN JOURNAL OF PHYSICS
BRITISH INTERNAL COMBUSTION ENGINE RES INST ABSTRACTS
BRITISH JOURNAL OF APPLIEDPHYSICS
BULLETIN DE LAINSTITUT INTERNATIONAL DU FROID
BULLETIN DE LA SOCIETE CHIMIQUE DE FRANCE
CHEMICAL ENGINEERING SCIENCE
CIVIL ENGINEERING AND PUBLIC WORKS REVIEW
ELECTRONICS AND POWER
GEOTECHNIQUE
INORGANIC AND NUCLEAR CHEMISTRY LETTERS
INSTITUTION OF MECHANICAL ENGINEERS PROCEEDINGS
INTERNATIONAL JOURNAL OF MACHINE TOOL DESIGN AND RESEARCH
JOURNAL OF APPLIED CHEMISTRY
JOURNAL OF DOCUMENTATION
JOURNAL OF PHYSICS AND CHEMISTRY OF SOLIDS
JOURNAL OF THE ROYAL AERONAUTICAL SOCIETY
KALTECHNIK KLIMATISTERUNG
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[Sample Vendor List]

```
MAGAZINE AGENCY,FIFTH AVENUE,NEW YORK

AMERICAN JOURNAL OF PHYSICS
AMERICAN MATHEMATICAL MONTHLY
ANNALS OF MATHEMATICAL STATISTICS
APPLIED OPTICS
ARCHIVES OF BIOCHEMISTRY AND BIOPHYSICS
AUTOMATION AND REMOTE CONTROL
BELL SYSTEM TECHNICAL JOURNAL
BIOTECHNOLOGY AND BIOENGINEERING
CANADIAN TEXTILE JOURNAL
CHEMICAL ENGINEERING
COLLEGE AND RESEARCH LIBRARIES
COMMUNICATIONS ON PURE AND APPLIED MATHEMATICS
ELECTRICAL AND ELECTRONICS ABSTRACTS
ELECTRICAL ENGINEERING IN JAPAN
ENERGY INTERNATIONAL
HYDROCARBON PROCESSING AND PETROLEUM REFINER
IEEE TRANSACTIONS ON AEROSPACE AND ELECTRONIC SYSTEMS
IEEE TRANSACTIONS ON CIRCUIT THEORY
IEEE TRANSACTIONS ON POWER AND APPARATUS SYSTEMS
INSTRUMENTS AND EXPERIMENTAL TECHNIQUES
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[Sample Vendor List]

```
ENERGY INTERNATIONAL
500,HOWARD STREET
SAN FRANCISCO,CALIF 94105
U.S.A.

DEAR SIRS WE ARE SUBSCRIBING TO THE BELOW
MENTIONED PERIODICAL. WE FIND WE HAVE NOT
RECEIVED THE ISSUE AS BELOW,NOW OVERDUE.
KINDLY SEND US A REPLACEMENT TO KEEP OUR
FILES UP-TO DATE.


ENERGY INTERNATIONAL/00160011
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[Sample Overdue Notice]

DISCUSSION

Mr. Ralhan: There was no provision while updating records, for a check to ensure that the correct serial number or code number had been punched for a periodical. A dictionary in the memory of the computer was necessary so that each of the code number could be automatically compared with corresponding name of the periodical. This self-checking device would greatly reduce the possibility of an error while updating the records.

Mr. Haravu: This type of check device would really be useful for detecting any type of error committed during punching of the cards or at the time of coding itself. But only trouble is to get a suitable device.

Mr. Raizada: The Aslib team, during its last visit to Insdoc, had disclosed that they were working on this problem and had developed a self-checking device. But the exact procedure followed by them was not known.

Mr. Sharma: The experiment done by Mr. Haravu was quite useful and suggested that the result of such type of experiments should be circulated throughout the country, particularly to university and special libraries. The intake of the periodicals on the libraries of various universities, varies from 1000 to 1500. Handling of such a large number of periodicals with the help of conventional methods was difficult and troublesome. It was necessary, to replace them by new techniques such as the one presented here.

Mr. Vij: Whether circulation of the periodicals could be controlled with the help of computer?

Mr. Haravu: It could be done in a limited way by printing the exact number of list of newly received periodicals as required in different departments of the organisation.

Mr. Rahlan: What language was used for programming and which of the routines created problem during programming?

Mr. Haravu: The Symbolic Programming System or SPS was the language used for programming. The generation of the Master file was straight forward and it did not create any problem. However, the updating and reminder routines created some problems.

Mr. Muthukrishnan: It would have been better to use FORTRAN than an assembly language like SPS. Its use would have reduced the labour of coding by 50%.

Mr. Nazir: The works related with updating the records and sending of reminders were done almost daily. Whether it would be practical to postpone them for a week or fortnight to do by computer?

Dr. Thakore: In most of the libraries the reminders were not being sent daily. A gap of a week or so was always maintained. So to do it with the help of computer would not change the frequency of doing this job. Same is true, more or less, in case of updating the records.

Mr. Raizada: In doing a job by a new method or novel technique, some changes in the system of organisation are always essential. Probably the conventional approach may have to be completely discarded.

Mr. Kapoor: Although a computer could be programmed to do many works, but it should not be employed for doing trivial jobs. It must be considered whether it would be economical and worthwhile to use a computer for a job?

Mr. Vijifdar and Mr. Ralhan: Mr. Kapoor's statement is out of context.

DISCUSSION

Dr. Sharma: Whether care had been taken of the receipt of back numbers of the periodicals?

Mr. Haravu: This could also be treated in the same way as the receipt of current periodicals.

Mr. Raizada: It is not necessary to stick to run the computer every fortnight for updating and other routines. The period could be adjusted to the individual requirement.

Mr. Chairman: The topic discussed is a new one and still in the experimental stage. The available literature has revealed that nowhere in the world computer had been used with complete success for the control of serial records. It is really graceful and refreshing that we are making efforts in this direction.

Review

Special Libraries and Information Services in India and in the U.S.A. by J Saha. Metuchen N.J., Scarecrow Press Inc. 1969, 216p. $ 5.00 [Reviewed by T S Rajagopalan]

This handsome publication is the outcome of the visit of Mr J Saha, Chief Librarian, Indian Statistical Institute, Calcutta to the United States for three months in 1967, which was made possible by a U.S. Air Force research grant. The Graduate School of Library Science, Rutgers University has made arrangements for the visit of Mr Saha. The aim of this publication is two fold — to present to the U.S. readers an account of the special library scene in India and to present to his Indian colleagues an analysis of the current documentation activity in the U.S.A. which is based on his observations of the few special libraries and information centres visited by him and on the discussions he had with a few leading figures in the field. Mr Saha is familiar with the problems of special libraries in India and his account of the Indian situation is to be regarded as authoritative. The Indian Statistical Institute has provided him with enough scope to have an insight into the problems of mechanisation in library and information work and it is this aspect which has naturally received his main attention in the U.S.A. The survey of current and projected mechanised services in the U.S.A. which Mr Saha has tried to give in this book, would be read with interest by his Indian colleagues to whom the present developments taking place in the U.S.A. are yet distant goals.

The book is in two parts — the first part deals with India and the second part deals witl the U.S.A. While the first part covers all aspects of special libraries in India, the second part is limited to his observations and study o the mechanised services in the few libraries and information centres visited by him in the U.S.A. There are a large number of extracts in both the parts from the works of others which have been reproduced in the text and cited in the bibliographies at the end of each chapter.

The short report of the special libraries in India described in the first part is addressed to his U.S. colleagues and could therefore be only a broad survey without any critical evaluation. However from the point of view of Indian readers, a more detailed and critical appraisal would have been expected. A few notable contributions have appeared after Mr Saha has finalised his draft, making his own account of the special libraries in India not very current. While examining each chapter seriatum the reviewer has tried to mention the latest sources of information and a few omissions noticed by him. This has been attempted to bring Mr Saha's book more comprehensive and uptodate.

The first part begins with the chapter devoted to the development of modern science in India since the advent of the British, to provide the background for the library and information services discussed in the subsequent chapters. Library and information services are now-a-days regarded as infra-structure facilities for research and developmental activities and it is appropriate that Mr Saha begins with a chapter on organisation of science. This chapter gives the chronological development of major scientific research institutions and mentions the role of scientific societies in fostering awareness in science. Among the scientific complexes the Council of Scientific and Industrial Research alone is dealt with while mention about the Indian Council of Agricultural Research, the Indian Council of Medical Research, the Defence Research and Development Organisation, the Atomic Energy Commission, the Cooperative Research Associations etc., could have also been made. In the appendix to this chapter a list of national laboratories under the Council of Scientific and Industrial Research and a list of 62 universities have been included. No mention has been made of the Indian Institutes of Technology, postgraduate institutions in Medicine, agricultural universities, research institutions controlled directly by the Central and State Governments, private research institutions, R & D establishments in industry etc. The Directory of Scientific Research Institutions in India published by Insdoc in May 1969 provides a more comprehensive and uptodate account of research institutions in our country. The 1969 Handbook of the Inter-University Board of India and Ceylon is perhaps the latest source of information on our universities. There are more than 80 universities now, in addition to 8 institutions deemed to be universities. The University Grants Commission has established atleast 20 Centres for Advanced Study in various subjects fields in some of the universities. Insdoc is currently engaged in compiling a Directory of Scientific Societies in India, and when brought out will give a more uptodate account than the Scientific Societies in India brought out in 1965 by the C. S. I. R. Survey and Planning of Scientific Research Unit which Mr Saha has used for the analysis of information. Data on government expenditure on scientific research for the period 1952-53 to 1961-62 have been given based on the studies of Prof P C Mahalanobis and Mr A Rehaman and others. However data upto 1968-69 have now been compiled by the Committee on Science and Technology (COST) of the Central Cabinet. This chapter should have also dealt with the growth of scientific manpower and the growth of scientific literature in India which have a bearing on the growth potential of library and information services. The subject 'Organisation of Science' has been the main theme of the CASTASIA Conference held by Unesco in New Delhi in 1968. A well documented report on the Organisation of Scientific Research in India prepared by Insdoc for the exclusive use of the official Indian Delegation to the CASTASIA Conference provides the most comprehensive and uptodate account of the state of science in our country.

The second chapter is devoted to library services in India. It is not restricted to special libraries only as is evident from the heading of the chapter and some of the statistical data presented. Social Science libraries are not covered in this chapter and they have been dealt with in another chapter devoted to Documentation on Social Sciences. Handicapped for want of uptodate and reliable sources, the data on the growth of libraries and other details given about them could not but be incomplete and out-of-date. There may be atleast 600 science libraries in our country now. The reviewer's recent paper on the Development of Special Libraries in India in the Fourth Plan Period (Presented at the All-India Library Conference held at Tirupathi on 28-31 December 1969) has attempted to bring the picture more uptodate. The plans for the establishment of the National Science Library, the National Medical Library, the Indian National Agricultural Library, and the Library for Social Sciences have been outlined in that paper. Further some basic data about the special libraries and the financial resources for their development in the Fourth Plan period have been given. Another paper by Mangala and Sardana on the Development of Academic Libraries in the Fourth Plan Period submitted at the same conference contains valuable data on the growth and development of university libraries in our country. However the data about our libraries are insufficient and out-of-date and this points out to the urgent need for the compilation of a Directory of Libraries in India. The Directory of Special Libraries in India brought out by IASLIC in 1958 is very much out-of-date now. Insdoc has currently undertaken a survey of the library and information resources of CSIR institutions and the findings are expected to be published shortly.

The next chapter deals with bibliographical services in India. Some of the bibliographies and abstracting services that have been brought out are enumerated. The list is of course not complete. The Bibliography of Scientific Publications of South and South-East Asia has not been mentioned in this chapter (described in the chapter on Insdoc). This publication has provided bibliographical control of Indian scientific literature from 1949 to 1964 and thereafter was replaced by the Indian Science Abstracts. Except for the period of 1940 to 1948 which was marked by war and handing over of power by the British, we are continuously having bibliographical control of Indian scientific literature from 1935, thanks to the pioneering attempt of the National Institute of Sciences to publish the Indian Science Abstracts from 1935 to 1939. This chapter should have also dealt with the growth of Indian scientific documents. It is not expected that this chapter should list exhaustively all our bibliographical attempts. However in the reviewer's opinion the following publications, to mention a few, deserve to be mentioned in this chapter:

Accession list. New Delhi, American Libraries Book Procurement Centre. 1962-

Council of Scientific and Industrial Research: Indian scientific and technical publications: exhibition 1960. Bibliography. New Delhi, The Council. 1960. 195p.

——: Indian scientific and technical publications 1960-65. New Delhi, The Council. 1966. 284p.

Das Gupta, A K: An essay in personal bibliography - Ranganathan festschrift V. 2, a bibliography of the writings on and by Dr S R Ranganathan. Bombay, Asia Publishing House. 1967. 405p.

Gidwani, N N and Narlani, K: Indian periodicals: an annotated guide. Jaipur, the authors. 1969. 191p.

Impex reference catalogue of Indian books. New Delhi, Indian Book Export and Import Co. 1960. ----- Supplement 1960-62. 1962. 215p, 219p.

Index India: a quarterly documentation list of selected articles, editorials, notes, letters etc. from periodicals and newspapers published in English language all over the world. Jaipur, Rajasthan University Library. 1967-

Indian Book reporter. Gurgaon, Prabhu Book Service. 1964-.

Indian Books — an information leaflet. Calcutta, Mukerjee Book House. 1968-

Indian Press Index. Delhi, Delhi Library Association. 1968-

Inter-University Board of India and Ceylon: Bibliography of doctoral theses in arts and science accepted by Indian universities during 1954-58. 1959. 103p.

----- Research in progress 1958-66: V 1 Physical Sciences. 1968. 429p; V 2 Biological Sciences. 1968. 357p; and V 3 Humanities and Social Sciences (under preparation).

Mukherjee A K: Reference work and its tools. Calcutta, World Press. 1964. 335p.

National Library, Calcutta: Bibliography of Indology: V 1 Indian anthropology. 1960. 290p; V 2 Indian botany. 196p. 2pts. (mentioned in the chapter on the Indian National Bibliography).

Nifor guide, to Indian periodicals 1955-56. Poona, National Information Service. 1955. 385p.

Ruprail N: Directory of Indian scientific periodicals, 1968. Delhi, Insdoc. 1968. 182p.

Sengupta B: Indiana-a select list of references and representative books on all aspects of Indian life and culture. Calcutta, World Press. 1966. 125p.

Sher Singh and Sadhu, S N: Indian books in print 1955-67 - a select bibliography of English books published in India. Delhi, Indian Bureau of Bibliographies. 1969. 1116p.

Singhvi, M L and Shrimali D S: Reference sources in agriculture - annotated bibliography. Udaipur, Rajasthan College of Agriculture Consumer's Cooperative Society. 1962. 418p.

6 However not all of them have appeared before Mr Saha has finalised his draft. Several bibliographies on specific subjects have been brought out from time to time by librarians, scholars and publishers (e.g. Dr J S Sharma's bibliographies on the Freedom movement, Jawaharlal Nehru, Mahatma Gandhi etc.). Some of them were printed and some of them were distributed in mimeographed form. Many libraries have published their catalogues of holdings both monographs and serials. Many universities have compiled lists of doctoral dissertations accepted by them. Mr Saha has mentioned about the union catalogues that have been published, in the chapter on Insdoc whereas it would be appropriate if they are described in this chapter. The documentation lists that have been put out by our special libraries have also been listed in this chapter. Mr B Guha in his article on Indian Current Awareness Services (Unesco Bull Lib 1968, 22, 73-81) has analysed these documentation lists. The documentation lists of the Atomic Energy Establishment (now called the Bhabha Atomic Research Centre) and the Indian Statistical Institute have been taken up as case studies and explained in a greater detail by Mr Saha to show the method of compilation of the lists.

Chapters 4 and 5 are on Insdoc and Desidoc respectively. The historical development and current activities of these two organisations have been described. Mr Kesavan in a recent contribution "Documentation in India" (Reprint from Lib Trends 1969, 17(3), 231-44) h has dealt with authoritatively the role of Insdoc, especially in recent times, in supporting scientific research activities. The following details about Insdoc supplement the information provided by Mr Saha in this chapter. Insdoc has been carrying on experimental work in mechanised information services. Some useful results have been obtained and quite a few projects using computer techniques have been completed. In recent times Insdoc has been undertaking a massive translation programme under a contract from the National Science Foundation of U. S. A. Insdoc has drawn up detailed plans in the establishment at national level an Electronic Information Grid and an Aeronautical Information Service and both of them are awaiting implementation by the authorities concerned in collaboration with Insdoc. The compilation of the Directory of Scientific Research Institutions in India in 1969, wherein 913 institutions are listed according to various complexes is a major achievement. The proposal to set up the Russian Science Information Centre as a part of the Indo-Soviet scientific collaboration, is shortly to be taken up by Insdoc under the auspices of the National Institute of Sciences. The information about Desidoc is same as that contained in an information pamphlet brought out by Desidoc. Desidoc has conducted an Information Seminar at New Delhi on 4-6 December 1969. Many areas of Information Science were considered at the seminar. Several papers dealing with the problems in handling and servicing of information of Defence Science interest have been presented at the Seminar.

There is a chapter devoted to the Indian National Bibliography. It has traced the genesis and described the scope and structure of the Indian National Bibliography. Analysis of the data on the publications recorded in the Indian National Bibliography has been attempted to show the trend in book production. In this context, the efforts of the American Libraries Book Procurement Centre of the Library of Congress to bring out the Accession List — India since 1962 deserves mention. The Accession List is not only a helpful bibliographical tool for current Indian books but is also more regular in publication. The problem of languages and the need for transliteration accompanied with it, have been solved in the Accession List by using type-writen based composition. Among the private ventures, the recent publication — Indian Books in Print, 1955-67: a select bibliography of English books published in India, compiled by Sher Singh and S N Sadhu in 1969 is much to be applauded being the result of hard and sustaining work of two individuals. They hope to keep the publication current by issuing annual supplements. The Indian Book Reporter published by Prabhu Book Service since 1964 and the Indian Books — an information leaflet published by Mukherjee Book House since 1968 are also worth mentioning.

The next chapter on Documentation in Social Sciences traces the growth of Social Sciences research centres and of the special libraries devoted to them. A few major libraries could alone be mentioned in this chapter. For example, the Library of the National Archives and the Nehru Museum and Library have not been mentioned. Some of the abstracting and indexing services in Social Sciences have been described. The recommendations of a few seminars held in our country urging the development of Social Science documentation have also been listed. The Report of the Committee on Social Science Research published by the Planning Commission in 1965 has surveyed the existing research facilities and suggested measures for augumenting them. Thanks to the initiative of the Central Government and especially of the present Union Minister for Education and Youth Services Prof. V. K. R. V. Rao, the Social Science Research Council has been established in 1969. It is a happy augury that this Council even in its first year of existence has taken active interest in the promotion of documentation facilities in Social Sciences. A Sub-Committee has been set up to advise the Council on documentation matters. A Division of Documentation has been created with a head and other supporting staff. This Division is presently engaged in the tasks of compiling the union catalogue of serials and of preparing bibliography of Indian theses in Social Sciences. The Council has also started supporting financially libraries and institutions in some of the documentation projects being undertaken by them. The broad policy appears to be that the Division of Documentation will not itself involve in active documentation work but may expect specialised institutions which have already resources and facilities to carry out on a national scale documentation work in specific areas. Index India by the Rajasthan University Library and the Indian Press Index by the Delhi Library Association are some recent attempts in Social Science documentation and it is gratifying to note that the Social Science Research Council has started supporting them.

In the chapter on education in library science and documentation, the library science courses at present offered by our universities have been listed. Now more universities are offering B. Lib. Sci. courses. In addition, Delhi, Banaras and Bombay Universities (not mentioned by Mr Saha) are offering M. Lib. Sci. courses. A few more universities are also contemplating to start M. Lib. Sci. courses. The Bombay University course in M. Lib. Sci. is different from that of Delhi and Banaras Universities as the emphasis here is more on the completion of a research project and submission of thesis. The Madras University has not yet started M. Lib. Sci. course as mentioned otherwise by Mr Saha. The rapid turnover of Library Science graduates from our universities should be studied from the point of view of opportunities and employment potential lest there is no over production. It is hoped that this problem is engaging the attention of our planners in education for librarianship. The University Grants Commission is presently examining the teaching of Library Science in the universities through an expert committee. The recommendations of the Seminar on Teaching of Library Science in India held by the Department of Library Science, University of Delhi on the B. Lib. Sci., M. Lib. Sci. and research programmes have been reproduced in this chapter. The history, development, courses of studies etc. of the documentation courses of the Documentation Research and Training Centre and Insdoc have been given. Both the courses are now recognised as equivalent to Masters degree. Mention has also been made of the Insdoc Training Course on Scientific Translation. The Iaslic has also limited facilities for training in documentation and translation.

The nineth chapter is on research in Library Science. It naturally covers the research contributions of Dr S R Ranganathan mainly. The important journals in Library Science and Documentation and the standards on Documentation brought out by the Documentation Sub-Committee of the Indian Standards Institution are enumerated. The Bibliography of the writings on and by Dr S R Ranganathan compiled by A K Das Gupta gives an exhaustive account of all the research contributions of Dr S R Ranganathan though it covers upto only. It also shows the impact of the contributions of Dr Ranganathan universally. It is significant to note that India has the unique distinction of the government recognising research in Library Science by appointing Dr S R Ranganathan as National Research Professor. The Iaslic started in 1967 the Indian Library Science Abstracts for providing bibliographical control of Indian contributions. Unfortunately only two issues have come out. In some of the major cities study circles have been functioning wherein research contributions are presented and discussed. The Iaslic Study Circle at Calcutta, the Study Circle of the Delhi Library Association and the Study Circle of the Academy of Documentation, Hyderabad may be mentioned as examples. Insdoc has also been engaging itself in research activities and in recent years some useful results in mechanical methods of information retrieval and in reprography have been obtained. In addition to the Documentation Research and Training Centre and Insdoc, the Departments of Library Science in the universities would also become centres of research in due course.

The last chapter in Part I describes the role of library associations and in particular of the Indian Library Association and the Iaslic and of the several seminars and conferences held by them. The recommendations made at a few important seminars of these two bodies are also listed. It is a moot point to consider how far the recommendations made at these con conferences have been implemented. The organ of the Indian Library Association is presently known as the ILA Bulletin. The title has witnessed several changes posing problems to the cataloguers. The Indian Library Association has started celebrating the National Library Week in the month of November since 1968. The Iaslic has been very active and playing a useful role. The Indian Scientific Translators Association functioning from Insdoc since 1965 is also worth mentioning.

Part II begins with the chapter 'Prolegomena' which describes the object of his visit to the USA, and mentions the special libraries and information centres visited by him and the specialists in the field with whom he had fruitful discussions. As mentioned earlier he has been mainly concerned with mechanised information retrieval and automated library services which he had tried to understand under three broad queries- How? for whom? and at what cost? But Mr Saha has chosen to deal with costing only in a greater detail in this chapter. He has tried to understand the cost factor after studying the existing literature on the subject, by having discussions and by observing critically the working of the information centres which he had visited. He has however not drawn any conclusions of his own, which could provide guidelines to his Indian readers. He feels that comparison of cost data between manual and machine methods would be incomplete and misleading unless the operations in the two systems are standardised and the functions are assessed quantitatively

and qualitatively. The chaning

and qualitatively. The changing role of libraries in the context of increasing acceptance of the information centre concept has been briefly touched upon in this chapter also whereas the next chapter is entirely devoted to it. He has observed that information services will go beyond the traditional concept of reference services in libraries and that the gap between the library and the information centre is narrowing with libraries assuming more and more responsibility for serving the information needs of the scientists. Eventually the distinction between special libraries and information centres would vanish. The pre-processes to feed the machines are usually time-consuming and must be completed quickly if machine methods are to be employed for saving them. There should therefore, be speedy mechanism for acquisition of literature and completing the intellectual part of processing. However, the manual methods are no less time-consuming at the input stage. The time taken at the input stage is adequately and rather proportionately compensated at the output stage, which is more valuable because here the user's time is involved. After all, all our efforts are directed towards saving the time of the user. Mr Saha stresses the importance of systematic user studies to measure the performance of information activities. In fact, this is widely followed in the U. S. A. and other countries. He

has mentioned about the studies mo

has mentioned about the studies conducted at the Denver Research Institute, the Defence Documentation Centre and the Hernar and company which have all pointed out to the low percentage of use made of the information services. Such user studies are very much required in our country now. Unless there is strong interaction between the library and the information centre on the one hand and the user on the other, the information activities will not develop along correct lines. Mr Saha then deals with the need for subject knowledge for information personnel and mentions how more scientists are drawn into information work. The involvement of scientists in information work is very much emphasised in Weinbrug's report "Science, Government and Information". The position in our country now is very much different and scientists are yet to appreciate that information work is to be regarded as an integral part of actual scientific pursuit.

The next chapter traces the development of special libraries and technical information centres in the U. S. A. The role and character of information centres and some of the important mechanised information activities performed by them have been described. The changing concept of 'Documentation' ever since Otlet used the term in 1907 has been dwelt upon. The rapid proliferation of information centres in the field of Science and Technology is due to the fact that the conventional library systems were adequate upto twentieth century, that the special libraries then developed to provide specialised services and that the present day information centres are further extension of that trend. However, the trend in the USA has been that the information services are taken out more and more away from library activity. The recent changes in name of the American Documentation Institute into the American Institute of Information Science and the Journal of the American Documentation into the American Journal of Information Science are significant in this context.

Chapter 13 is on 'Libraries and Mechines'. After tracing how a few libraries have devoted attention to automation of some of the library operations for a long time, Mr Saha has described the current developments in automation in libraries in the U. S. A. He feels that with successive developments in technology many newer and more sophisticated machines for library purposes would come into being and that it is difficult to conceive of the future projections of automation programmes in libraries. He then passes on to indexing as a preliminary to the application of machine methods and mentions about the three major innovations in indexing methods — "Uniterm", "Descriptor" and "Role Indicator". He then describes how big and small libraries try to adopt fully or partially automated library services. With more institutions employing automation, the need to standardise the entry of information and the pattern of operations in order to develop an integrated system is stressed upon. In fact, some of the large scale mechanised projects such as MEDLAR and MARC are developing into global programmes with far reaching consequences and the integral system would be developed even beyond the boundaries of the USA.

The next chapter is on Library education and Information Science. As the title indicates, Mr Saha has tried to present how there has been a shift towards inclusion of more and more of Information Science in the curricula of library schools. He describes how the curriculum for library education are oriented more strongly towards scientific and technical literature and include a knowledge of the new concepts of information storage and retrieval. He has analysed the course content of a few important library schools to show the changing emphasis being placed on the inclusion of Information Science. Mr Saha has also described the courses on Information Science now being offered by a few universities. In this respect, our Library Science departments in the universities are still following the traditional pattern of library education. Perhaps, the time is not yet ripe for such changes in Scientific Documentation.

The last chapter reports the trends in research and development in the fields of special libraries and Information Science. For this purpose, he has attempted an analysis of the research projects undertaken and reported in a few numbers of the Current Research and Development. Approximately 70 per cent of the recorded researches are of U.S. origin. There has been an increase of over 154 per cent in the number of projects over a period of four years. Information storage and retrieval remains the major area of research activity. At least 35.9 per cent of the research projects are carried out by 'Industry' followed closely by 'University' with 34.5 per cent. The major developments in mechanised information services in the U.S.A. are the results of extensive research and developmental activity. The recommendations of the Committee on Scientific and Technical Information on the need for increased researches in the areas, user studies, document representation, evaluation tools and techniques, communication of information, and equipment for information handling have been highlighted in this chapter.

Appendix to Part II contains short reports of 7 libraries and information centres in industry, 2 under federal agencies, one under private agency, 2 under special libraries and 4 developmental projects. They are quite informative. It would have benefitted most his Indian readers if Mr Saha has given some of his salient observations seriatum and his own assessment for providing guidelines as to their adoption in our country. However, there is enough material in his report to show the trend in the current information activities in the U.S.A. and to examine as to what extent the experiences of the U.S.A. would be valuable to us. Computer applications are gradually gaining ground in our country. The administrators, scientists and technologists, and business men have begun to appreciate the need for computers. So also, libraries and information centres are aware of the potentiality of computers in their work. However, the use of such sophisticated equipment would have to be in relation to our general social, economic and technological background. Computers are available now only at a few institutions. They are mostly imported. Computers have to be freely available at all the service points if mechanised information services are to be made use of. There are also limitations in using global services such as MEDLAR, Chemical Abstracts etc unless we function as a part of the integrated system. Even in the U.S.A., is stated that many of the mechanised information projects are in experimental stages It may therefore, take a much longer time in our country for the practical application of computers in information work. However, it is wiser to keep in touch with the current developments taking place in advanced countries such as the U.S.A. and make small begining now onward so that when conditions for introducing automation are favourable, we are not hopelessly lagging behind. In this context, the experiences gained in the visits to the U.S.A. by senior librarians like Mr Saha would prove rewarding.

The book is a welcome addition to the literature on Library Science and Documentation. It has contributed to the understanding between a developed nation and a developing nation, in matters of scientific information. Students of Library Science and Documentation courses in India would find it as a good text bo book. It is also a source book of information to experienced workers. The production of the book is excellent. It is not also very expensive.

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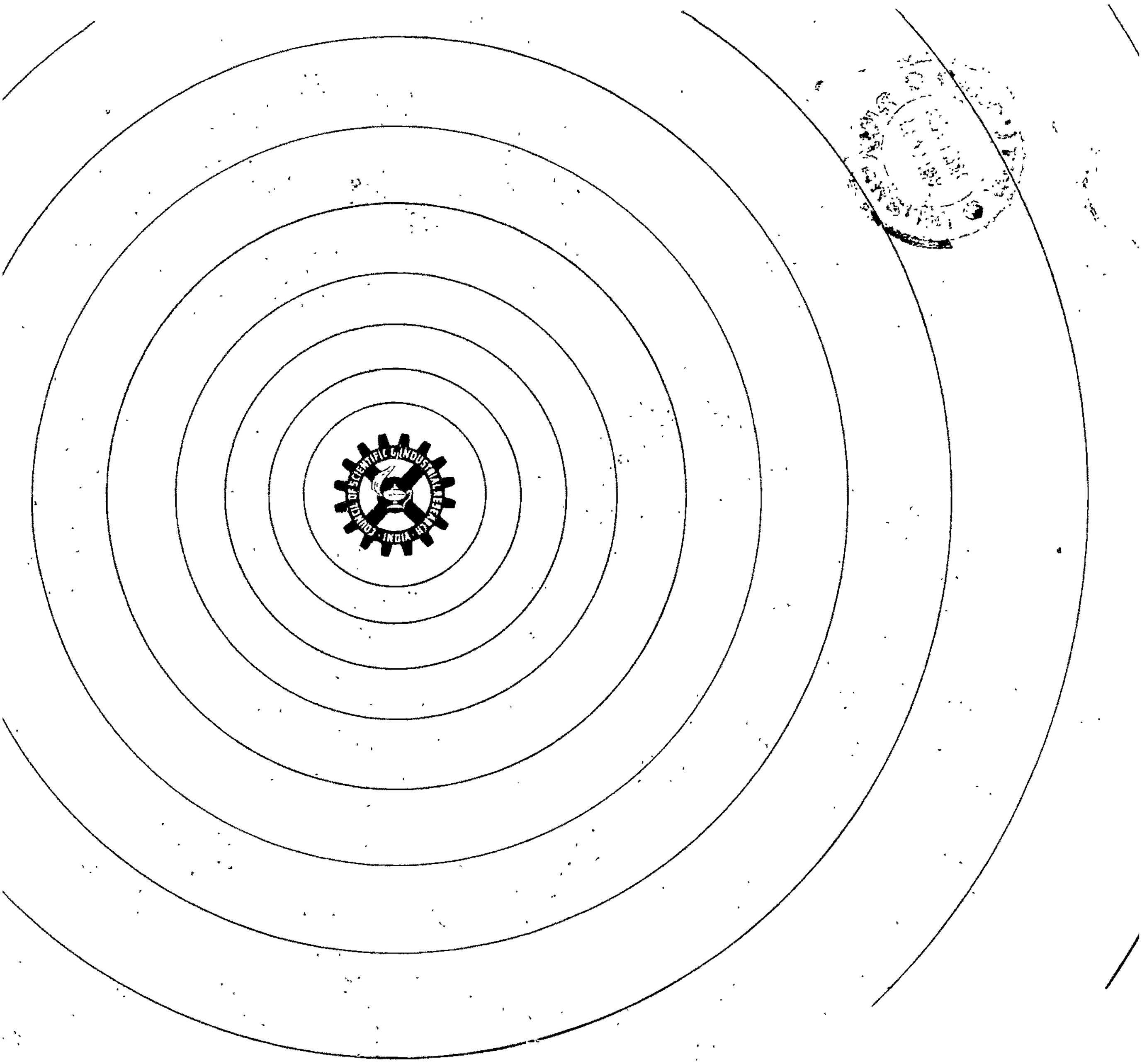

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AN EXPERIMENT IN MECHANICAL STORAGE AND RETRIEVAL OF INFORMATION IN INTERNAL TECHNICAL REPORTS

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Observations are made on an information processing system designed and installed at the Indian Institute of Petroleum, based on the principle of keyword indexing coupled with the use of punched cards as storage medium and electric sorter for retrieval. Apart from versatility, speed and flexibility of the system, the low cost of the sorter is an advantage as compared to computers, whose costs are prohibitive for many organizations with a modest budget.

INTRODUCTION

A technical information system(1) has been designed and installed at the Indian Institute of Petroleum (IIP), based on the principle of keyword indexing. For this purpose, the roles of A.I.Ch.E., and a thesaurus on cards prepared by the Coordination & Information Division (COIN) of IIP are used as tools to achieve syntactic and vocabulary controls, using punched cards as the medium of information storage and an electric sorter for retrieval of data and references against specific enquiries. The keywords are numerically coded in the thesaurus, and while indexing, they are converted into binary equivalents for punching. A combination of numerical code numbers and roles makes possible the association of keywords semantically in a number of ways describing the concept under search, thereby providing flexibility of retrieval by using more than one way of query formulation on the basis of likely interests of the users. Presently, the system is being utilised to index articles from scientific journals; statistical data pertaining to oil industry; bio-data of scientific and technical personnel of the Institute; and internal technical reports.

This article attempts to describe briefly our experience with the information processing system in the area of internal technical reports of IIP which embody the R & D effort ever since its inception.

SEQUENCE OF OPERATIONS

Card Design - Scanning/Digesting - Keywords Extraction - Role Assignment - Codification - Programming - Punching - Verification/Checking - Storage.

Card Design

The 80 column card has been designed as shown in fig. (1), using all the 12 rows of the card. Columns 1 to 17 record information in direct code. Columns 1 and 2 indicate the Division to which the report belongs and the author's Division respectively. The author is numerically coded and punched in columns 3 to 6. Column 7 indicates the month, while columns 8 to 11 give the year to which the report belongs. Columns 18 to 30 are left blank for future needs, if they arise.

Columns 31 to 75 are assigned for indexing the subject matter by keyword analysis and using binary code, and the indexing field is divided into 12 zones. Zones from 1 to 10 correspond to the ten roles devised by A.I.Ch.E. Two additional zones 11 and 12 consisting of 5 columns and 6 rows each, have been provided for indicating the concepts of place and time respectively to suit our purpose, e.g., numerical equivalent for Digboi from our thesaurus is 0.0.17.1. Accordingly, the numbers 17 and 1 will be punched in rows 0 and 1 respectively, in zone 11.

In zone 12 for time we utilize 4th row for date, 5th row for month, 6th and 7th rows for the initial year and the 8th and 9th rows for the ending year of a specified year interval. A year not occurring in an interval is punched in the rows 8 and 9.

From our experience, the field required for punching space and time concepts could be smaller than that for the actual subject matter to be indexed and hence the roles XI and XII have been assigned one below the other, each with a 5 column and 12 row matrix. The design is illustrated below:-

Cols. Rows	Role I Columns: 31-38	Role II Columns: 39-46	Role III Columns: 47-54	Role IV Columns: 55-62	Role V Columns: 63-70	Role XI Columns: 71-75
Y						
X						
O	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 11
1						
2						
3						
4	Role VI	Role VII	Role VIII	Role IX	Role X	Role XII
5	Columns:	Columns:	Columns:	Columns:	Columns:	Columns:
6	31-38	39-46	47-54	55-62	63-70	71-75
7						
8	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10	Zone 12
9						

Fig. 1.

Role Assignment

In order to identify the distinctive contexts of the concept-carrying keywords and appropriately retrieve desired information, roles are assigned to various keywords. The American Institute of Chemical Engineers have categorised the roles which are particularly suitable for chemistry and chemical engineering; and they are reproduced below:(2)

1. Input to a chemical reaction, physical production, operation, electrical or mathematical system.
2. Product, output, byproduct, coproduct from the reaction, production operation or system.
3. Waste, contaminant, impurity.
4. Special agent, catalyst, accelerator, stabilizer.
5. Solvent, media, environment, support.
6. Independent variable studied for its effect.
7. Dependent variable studied how it is effected.
8. Active concept, subject of study.
9. Passive concept, object of study.
10. Device, material or method for accomplishment.

Expression of ideas is made by role-keyword combination, and there are many possible ways to express an idea. The efficiency of the retrieval system lies in its manoeuvrability through a multiplicity of these routes to find the same information from its store.

Codification/Programming

For the sake of simplicity, brevity and elegance, the numerical codes of different keywords are binarily converted and punched one below the other upto a maximum depth of

Scanning/Digesting/Keywords Extraction

A report is scanned for extracting keywords associated with concepts embodied therein, and the keywords are accordingly role numbered, taking due account of all routes of approach to the information which are likely to be used in the enquiry. Bibliographical information, viz., title of the report, number, names of authors, and month/year, is recorde at the back of the card. Keywords concept-wis are noted on the front.

six in any role-zone. In a particular row of a given zone, a punch in the first position is binarily equivalent to $2^0 = 1$, a punch in the 2nd position is $2^1 = 2$, that in the 3rd indicates $2^2 = 4$; and so on; and the last (8th) position $2^7 = 128$. Thus any number from 1 to 255 can be punched in a particular row. Further, a concept code isolated upto a depth of 6 can be converted into the binary system in a zone determined by its corresponding role. The isolate 12,3.16.4.7.5, for example, can be coded neatly one below the other in a role zone as illustrated below:-

12.3.16.4.7.5 can be coded either in the upper half of the card (comprising rows from Y to 3) or in the lower half (comprising rows from 4 to 9).

In the first row, $12=2^2+2^3$ (4th and 5th positions)

In the second row, $3=2^0+2^1$ (1st and 2nd position)

In the third row, $16=2^4$ (5th position)

In the fourth row, $4=2^2$ (3rd position)

In the fifth row, $7=2^0+2^1+2^2$ (1st, 2nd and 3rd positions)

In the sixth row, $5=2^0+2^2$ (1st and 3rd positions)

Let us take a practical example.

"Sulphur as a contaminant in Jet fuels"

'Sulphur' whose numerical equivalent from the "term file" is 12.3.78; and its Role as a contaminant is 3.

According to card design (page 120) the number will be punched in columns 47 to 54 and rows Y to 3 (positions ticked):

		47	48	49	50	51	52	53	54
$12=2^2+2^3$	Y			✓	✓				
$3=2^0+2^1$	X	✓	✓						
$78=2^1+2^2+2^3+2^6$	O		✓	✓	✓			✓	
	1								
	2								
	3								

Using coding sheets, a programme is prepared covering different concepts embodied. For economy of storage and elimination of the problem of matching, we resort to "superimposition of keywords"[1] for punching keywords occurring in the same role zone; and reduction of noise, if any, is achieved in the final sort by eliminating cards with punches in contiguous positions.

Punching/Verification/Storage

Cards are punched according to programme prepared, using manually or electrically operated punching machine, checked for errors, if any, and stored in cabinets designed for the card size (18.8 x 8.4 cms.).

RETRIEVAL OPERATIONS

Observations with 2 queries are described here:

Query (a):
Is there any report on the "Production of Fatty Acids from Paraffin Waxes"?

Analysis:	Paraffin waxes (numerical equivalent 12.1.1.18.1)	-	Role .I
	Fatty Acids (numerical equivalent 12.3.50)	-	Role II

Retrieval Chart

Rows	Columns			
Y	33	34	41	42
X	31	39	40	
O	31	40	43	44
1	32	35		
2	31			
3				
4				
5				
6				
7				
8				
9				

Machine Operation (Represented graphically No. 1)

Number of Run	1st	2nd	3rd	4th	5th	6th	7th
Row/Column	2/31	1/35	1/32	0/31	X/31	Y/33	Y/34
Time Taken	1 Min. 35 Secs.	2 Secs.	2 Secs.	2 Secs.	2 Secs.	2 Secs.	2 Secs.
Total cards Fed/ Cards sorted.	590/5	5/2	2/2	2/2	2/2	2/2	2/2

List of reports available noted from the cards sorted out:

1. Synthetic fatty acids from paraffin wax (Report No. 7.105)
2. Manufacture of fatty acids by oxidation of paraffin wax - an economic evaluation (Report No. 3.142)

Comments

(1) Though the observations are carried out upto 7th run for sorting the concept "paraffin wax - as a raw material", it can be seen that we get available information after 2nd run and there is no need to sort further.

(2) It is not necessary to search for the concept "Fatty Acids - Production".

(3) Total time taken for machine operation is (1 minutes 47 seconds + 1 minute for feeding and arranging in between) about 2 minutes only.

Query (b): Is there any report on the "Performance Evaluation of Lubricating Oils"?

Analysis:		
	Performance (1.2.33)	Roles VIII and IX
	Evaluation (10.5)	Roles VIII and IX
	Lubricating Oil (12.1.1.13)	Role IX

Retrieval Chart

Rows	Columns						
Y							
X							
O							
1							
2							
3							
4	47	48	50	55	56	57	58
5	47	48	49	55	56	57	
6	47	52	55	60			
7	55	57	58				
8							
9							

Machine Operation (Represented graphically No. 2)

Run	1st	2nd	3rd	4th	5th	6th	7th	8th	9th
Row/Column	4/58	4/57	5/55	6/55	7/55	7/57	7/58	6/52	6/47
Time Taken	1 Min. 35 Secs.	44 Secs.	44 Secs.	41 Secs.	38 Secs.	25 Secs.	18 Secs.	11 Secs.	4 Secs.
Total No. of Cards/Card sorted.	590/ 269	269/ 262	262/ 254	254/ 237	237/ 149	149/ 102	102/66	66/15	15/15

(Continued)

Run	10th	11th	12th	13th	14th	15th	16th
Row/Column	5/48	4/47	5/49	5/47	4/50	4/48	6/51
Time Taken	4 Secs.	4 Secs.	4 Secs.	3 Secs.	3 Secs.	3 Secs.	3 Secs.
Total No. of Cards/Cards sorted.	15/15	15/15	15/12	12/12	12/12	12/12	12/4

List of reports available noted from the cards sorted out:-

1. Lubricant Performance Evaluation by Caterpillar 1-G Test Technique (Report No. 44/361).
2. Lubricant Performance Evaluation by Kirloskar AV-1 Test Technique (Report No. 44/351).
3. Lubricant Performance evaluation by Kirloskar AV-1 Test Technique (44/331).
4. Lubricant Performance Evaluation Petter AV-1 Test Technique (44/352).
5. Lubricant Performance Evaluation by Kirloskar AV-1 Test Technique (44/345).
6. Lubricant Performance Evaluation by Kirloskar AV-1 Test Technique (44/346).
7. Lubricant Performance Evaluation by Kirloskar AV-1 Test Technique (44/347).
8. Diesel Engine Performance with Adulterated and Sub-Standard Fuels (44/210).

Comments

(1) Runs from 1st to 7th pertain to the search for the concept "Lubricating Oils"; from 8th to 11th for "Performance"; from 12th to 15th for "Evaluation" and 16th run is for noise reduction.

(2) It became necessary to search for all the concepts analysed in the query.

(3) After 15th run a card not conforming to the retrieval chart, by seeing through the punched positions, was taken and a position 6 6/51 different from the retrieval chart was selected for the 16th run. Toral cards sorted were 4 and rejected 8. The punches of the rejected cards were identical and since "6/51" position is not in the retrieval chart, the rejected ones are those where we get our information. This operation is called "noise reduction" or "elimination" by the principle of sorting for contiguous positions.

(4) Taking into account 5 minutes for feeding, etc., total time taken for machine operation comes to about 10 minutes.

Many row/column combinations for sorting are possible. With the help of retrieval chart and visual inspection of a few punch positions in the cards, sorting routes at random can be selected resulting in fewer operations and overall economy of time. Two such routes in respect of query(b) are given below and illustrated in graph No. 3.

Route No. 2.

Operation No.	Row/ Column	No. of cards fed	No. of cards sorted
1st	6/60	590	75
2nd	6/52	75	48
3rd	7/58	48	17
4th	7/57	17	14
5th	7/55	14	13
6th	5/57	13	8
7th	4/57	8	8
8th	6/47	8	8

Route No. 3

1st	7/58	590	107
2nd	6/60	107	28
3rd	5/57	28	17
4th	6/52	17	8
5th	6/55	8	8
6th	5/55	8	8

MERITS AND DEMERITS

Merits:

1. In the example "sulphur as a contaminant in Jet Fuels" the integrating concepts are completely isolated by placing "sulphur" in Role-3, Jet Fuels in Role-5 & 9 and if the document contains devices like chromatography, adsorption or catalysts used in a particular medium, they can be indicated in the respective zones on a single card, while separate entry is needed in a catalogue card system for separate concepts.
2. The number of cards and ultimately the storage space is reduced to a minimum.
3. The need for maintaining the cards subjectwise or alphabetically is completely dispensed with.
4. The coordination process in cards for matching components of each integrative concept proved to be quite tedious and time consuming, which are cut short by the process of superimposition of concept constituents and binary coding.
5. Manual sorting is easy and economical if the file size is small, say upto 1000. But when the cards swell up to 10,000 and more, mechanical sorting is quicker and less tedious.
6. Computers are not necessary even for large bulk processing of cards.

Demerits:

1. Initial capital cost of about Rs. 20-25 thousands is needed for the sorter assembly.
2. Considerable insight and care is needed during the extraction of keywords role asignment, programming, punching and varification. A wrong punch means "no retrieval".

CONCLUSION

By appropriate design of software, the simple electrical sorter can form the basis of a versatile, fast and flexible, information handling system. The low cost of the electrical sorter is an advantage as compared to computers whose costs are prohibitive for many organisations. The use of simple indexing and retrieval procedure described above can be considered by organisations desiring to achieve an economical, flexible, and simple information system.

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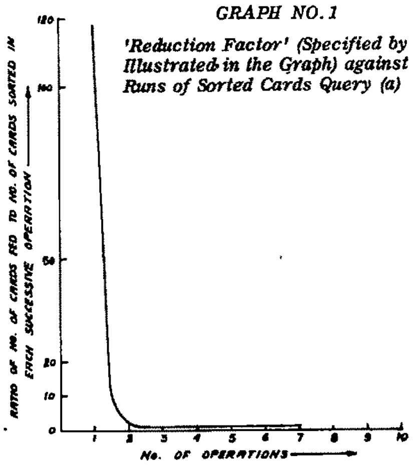
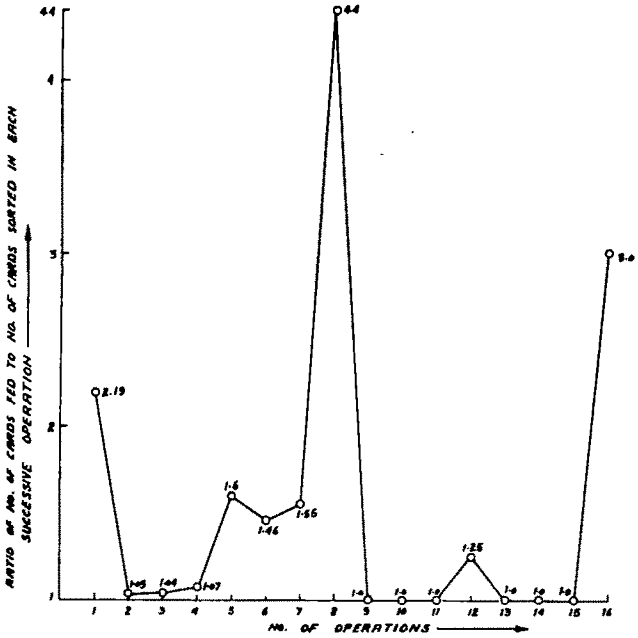


GRAPH NO. 1

'Reduction Factor' (Specified by the Ratio Illustrated in the Graph) against Successive Runs of Sorted Cards Query (a)

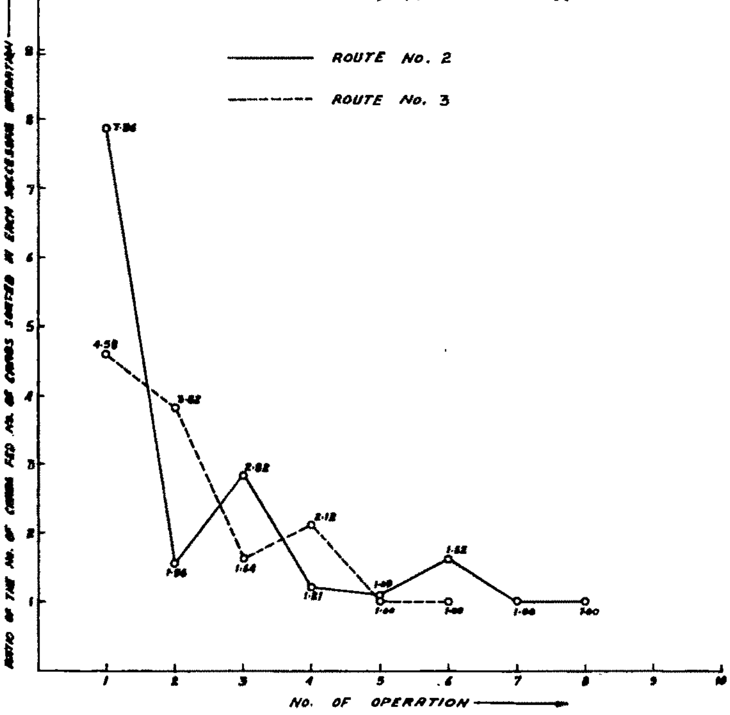
GRAPH NO. 2

Reduction Factor: Query (b)



GRAPH NO. 3

Reduction Factor: Query (b) - Two more Approaches.



Proceedings of the Seminar on Automation Problems in University Libraries and Special Libraries, Sessions E-H.

SESSION - E

APPROACHES TO AUTOMATED SYSTEMS IN LARGE ACADEMIC LIBRARIES

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The first part of this paper considers three general approaches to the development of an automation programme in large academic library. The library may decide simply to wait for developments; it may attempt to develop a total or integrated system from the start; or it may adopt an evolutionary approach leading eventually to an integrated system. Outside consultants, it is expected, will become increasingly important. The second part deals with important elements in any programme regardless of the approach. These include the working out the capability to do automation work, staffing, equipment, feasibility study and costs.

Introduction

From the earlier discussions it is clear that most computer-based systems in academic libraries, at present, are in the developmental or early operational stage. Improvement and modifications are frequent at this period. Also it is difficult to make a meaningful separation between the development, administration or management function. It is not attempted here, in this paper, to distinguish between developmental and administrative function but, instead, to discuss in an informal and non-technical way some factors to be considered by librarians and administrators when their thoughts turn to introducing computer systems into their libraries. Fortunately, in India they have now started thinking along this line.

I: Approaches:

The first task of a library administration is to formulate an approach to automation based on a realistic assessment of the institution's needs and resources. Planning a library building has some similarity in approach with automating a library. Each library is unique in some respects, and requires a building which is especially designed for its own particular needs and condition. There is nothing as such, library automation programmes.

Newly founded university and other advanced academic institution libraries which have small collection, but have resources, should take the logical course of attempting to design integrated computer-based systems for all library house-keeping operations, provided they have easy access to the machine and are allowed required amount of computer-time. Several other university libraries (viz. BHU, Bombay, Calcutta, Delhi, Madras, etc.) may approach in an evolutionary way and should design separate, but related, batch-processing systems for various house-keeping functions such as circulation, ordering, catalogue input and card production. Still other libraries expect to take little or no action until some order or pattern has begun to emerge from the experimental work that is yet to be undertaken in India. Only time will tell which of these courses will be most fruitful. Meanwhile, the library administration must decide what approach to take; and the approach to automation, like that to a building programme, must be based on local requirements and available resources.

a) The Wait-For-Developments Approach

The basic idea behind this approach is that practically all computer based library systems are in an experimental stage with questionable economic justification, and that it is unnecessary and uneconomical for every library to undertake difficult and costly development works. The advocates of this approach say that it makes sense to wait until the pioneers have developed some standardized, workable and economical systems which can be installed and operated in other libraries at a reasonable cost. This is a cautious approach which minimizes costs and risks. This is a reasonable position to take for the smaller ones. But, for the larger libraries, however, it overlooks, that soon, in order to cope with increasing workloads, they will have to develop the capability to select, adapt, implement, operate, and maintain systems that were developed elsewhere. The development of this capability will take time and will be made more difficult by the absence of any prior interest and activity in automation within the adapting institutions.

A major error in the wait-for-developments approach is the assumption that a time will come when the library automation situation will take some stable shape so that one can move into the field confidently. This probably will not happen for many years, if it happens at all, for with each new developments there is another more promising one just waiting on the door-steps. How long does one wait for the perfect system to be developed so that it can be easily "plugged in", and how does one recognise that system when one sees it? There is real danger of being left behind in this position, and a large library may then find it difficult indeed to catch up.

b) The Direct Approach to Total Systems

A library is a total functional unit and all its varied operations are inter-related and interconnected. The logic of the situation demands that it be looked upon as a whole by the system designers and that a single integrated or total system be designed to include all house-keeping operations in the library. Such a system should make the most efficient and economical use of the capabilities of the computer. This does not require that the entire system be designed and implemented at one time in the beginning, but it permits treating each component function as one of a series of modules, each of which can be implemented separately, though designed as part of a whole. Several large university libraries have chosen this method in U.S. The University of Chicago system is the most advanced.

Unlike the evolutionary approach this total system approach must be based on sophisticated third generation computers and other batch-processing equipment. This is expensive, complex, requiring trained and experienced staff and system designers. Since the development costs involved in this approach are considerable, the library must receive sizable financial grant before attempting this method.

The total system has logic in its favour; it always aims at the right goal and the goal should ultimately be attainable. Another fruitful result that should come out as a by-product of this development process is that it should push a big step forward of both library automation and computer technology. It should be expected that the first models will be economically and technically viable but it may be hoped that they will work well enough to serve as prototypes for later models. The pioneering libraries may very well suffer serious set backs in the process, and the authority should carefully weigh the risks and the gains for his own library.

c) The Evolutionary Approach to Total Systems

This approach consists basically of taking a long-range, conservative view of the problem of automating a large complex library. The ultimate goal is the same as that of the total systems approach but the method of reaching is different. In the total systems approach, objectives are defined, missions for reaching those objectives are designed and are usually in a series of computerized modules. In the evolutionary approach, the library moves from traditional manual systems to increasing complex machine system in successive stages to achieve a total system with the least disruption of current operations and services. Quite a few European and North American university libraries have followed this line.

In the first stage the library should undertake to design and implement a series of basic systems to computerize various procedures using its own staff and locally available equipment. The basic idea is to raise the level of operation-circulation, acquisitions, cataloguing etc - from existing manual systems until major portions of the conventional systems have been computerized. The problem with us is that we librarians are basically conservatives. We like to follow the present manual systems and stick to it even though we do not fully understand the reasons behind the operations of present manual systems.

At some point the library itself, computer hardware and software, all should have advanced to a point where it will be feasible to undertake the task of redesigning the simple stage-one systems into a new integrated stage-two systems built upon the operating experience obtained from the earlier systems design. In stage-one of library automation librarians are expected to learn computing and do this design and programming themselves rather than to teach computer people about the old manual systems and get the job done through them.

Use of Outside Consultants

Here is analogy with the usefulness of specialists, of architects, engineers etc. in planning and building a library building which the librarian will eventually use.

A qualified 'architect' for the system may be engaged to guide the library in designing the machine operated system. This consultant must have a thorough knowledge and experience of how the library systems work. His task, like the architects, would be to turn the general programme into a detailed systems design with the full aid and participation of the library's own systems group.

II. Prerequisites for Automation:

Regardless of the approach that is selected, there are certain prerequisites to a successful automation system. It requires time and money; it consists of stall, equipment (which may be hired), an organisation with a regular budget, and a certain amount of know how which is generally obtained by doing a series of projects. Success depends to a large extent on how well these resources are utilized.

Staff:

Nothing gets done without people. Hence, training and holding a competent staff is the most important single element in a library automation. The number of librarian with training in computer technology is extremely small. To attract people from the computer field the authority will have to pay more than they pay member of the library staff. On the other hand, it should not be too difficult to recruit one competent librarian with good potentiality who may be trained in computer. Taking loan of staff from computer centre for temporary use in Library may be poor risks since their professional commitments is to the computer world rather than that of the library.

There are various levels of library systems analysts and programmers, and the number and type needed will depend on the approach and the stage of a particular library's automation effort. The critical factor is not numbers but quality.

It would be a mistake to underestimate the importance of the role of key-punchers, typists and other machine operators. It is essential that these staff members are conscientious and feel responsible. They are responsible for the quality and quantity of the input, and therefore of the output, and they can do much to make or break the system.

Equipment

From my discussions with a few librarians using computer on shared-time basis I am convinced that a library cannot risk vital computer based systems on to equipment over which it has no control. This view is also being reflected in current literature. This does not necessarily mean that it needs its own computer. However, if it plans to rely on equipment under the control of others it must get firm and binding commitments for time, and must have a voice in administering the equipment. One cannot foresee what will be the trend in India. However, it seems reasonable to suppose that after a few years, several libraries, within and around big cities will group together to share a machine dedicated to library use.

Brookes is justified in saying that the success of the (second generation) digital computers, a device for performing logical and arithmatical operations on number, is unquestioned. Data which are almost wholly linguistic can also be handled by digital computers but, in general, the computer and its software, designed primarily for other purposes have to be 'bent' in rather complicated ways to do other than the most superficial routines on linguistic data and then only if a simple library logic can be imposed on the analytical processes they are subjected to. The design of most machines we use is adopted so that it is as convenient as possible for man to use. But we the librarians who are mostly concerned with linguistic and semantic data analysis have to make fundamental adjustment i.e. intellectually to a machine designed for another purpose. We all want to have a machine capable of doing what we want them to do, rather than our having to do what machine wants us to do. Our plea to the computer scientists who are working on the next generation of computers is to allowing the horse to be put before the cart.

Organisation

The process of automation, in India, is yet to be developed. It may be advisable not to have a separate unit in the library's regular organisational structure, at this stage. The best arrangement might be, as we have already discussed, to have one or two computer oriented library staff whose activities at this preliminary, stage is to carry feasibility study, systems analysis etc.

Feasibility Study

No academic library should embark on any time of automation programme without first acquiring basic knowledge by conducting feasibility study. One should make a detailed study or estimate of the actual costs of manually carrying out the operations concerned. It is during this study, systems analysis takes place. The method of analysis of the system - the whole library organisation or only one department --- is to separate each action step by step systematically and to specify them individually so that in the end all the pieces known and understood and their combination clearly defines the structure of the whole.

Systems analysis combined with users survey will be the source of data in quantitative terms which will be essential at the systems designing stage. This is invaluable because it provides information on the total amount of money under consideration within the project and should give a guide line to the initial expenditure in developing the mechanisation system.

In a study for a printed catalogue for the Stanford University Undergraduate Library Hays & Shoffners did a cost analysis of 6 different methods ranging from the manual card catalogue to computer photocomposition. They established under the local condition at Stanford, by the end of fifth year, the best computer method would be cheaper than the manual one. This and similar type of studies, if undertaken by the Indian University libraries would benefit most of us.

Costs

The cost of feasibility studies should be within the Library's reach-one, which is planning to mechanize its systems. The necessary stationery and computer- hour to hire is cheaper in India compared to that in western world. A few man-hours per week extracted from the existing library staff should be enough and no extra appointment of staff for this purpose would be required.

But the price of doing original development work in the library automation field should be extremely high- that in most cases such work cannot be undertaken without substantial assistance from outside sources.

To justify computer-based library systems on the basis of costs alone will be difficult because machine systems not only replace manual systems but generally do more and different things, and it is extremely difficult to compare them.

Conclusion

There is no such ready-made formula for library automation in any academic library nor one is waiting to be discovered and applied to any particular library. Each library is to decide for itself which approach or strategy seems best suited to its own particular needs and situation. Experience gained by the university libraries in Europe and North America should be very useful. The first move for the Indian Librarians is to carry feasibility study of their own libraries. Few libraries in India are in proper and up-to-date shape. It is common knowledge that many such studies have shown that a computer was not really needed at all, and that the information gained from the feasibility study was sufficient to improve the existing system so as to make it more efficient than the automated one first contemplated. This paper has also attempted to stress the need of qualified professionals with knowledge of computer and modern management procedures. Here the universities and other higher institutions who are conducting academic and professional training courses may come to a great help by producing new batch of library professionals who could take the initiative in formulating the pattern of our new library systems to meet the inescapable demand of this automation era.

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FORMALISING LIBRARY PROBLEMS BY SYMBOLIC LOGIC

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Attempts to formalise the statements in a library operation by means of symbolic logic for stream lining further data processing operation. Uses the notation of both the Principia and Polish system of Propositional Calculus. Illustrates the use of symbolic logic to common library search statements with the aid of truth values. Demonstrate the simplication of a flow chart by truth table. Manipulations like formula conversion and reduction were used to show their help in streamlining library instruction manuals. The application of logical possibilities for defining an optimum path in a complex network of library operations have been hinted. Statements of very simple, idealised and trivial problems are analysed to determine their logical structure using basic logical concepts and propositional calculus notation in step-by-step exposition.

The internal operation of a computer, the structure of computer languages and programming languages can only be really understood when we study symbolic logic. A logical organisation of these statements and their symbolisation may help the librarian to translate the verbal form of his problem into a language amenable to easy data processing operations. One of such preliminary data processing operations is the convenient flow-charting. The breaking up of the problem in convenient logical elements or the establishment of the logical flow in between these elements can be easily visualised in flow charts. In the present article the value of expressing statements of the problem in the library in terms of the notation of the propositional calculus will be discussed. This notation and the logical concepts and operations help to see the flow chart operation in clear perspective and also to simplify them. This is most useful in those cases when the computer will make only very simple yes-no type decisions. Other simplifications in the number of instructions in library manual may also be made. Some statements of very simple, idealised and trivial problems will be analysed to determine their logical structure. Even though problems in a real library when stated are of much greater complexity it is hoped that they will be structurally similar to some of the problems stated here. Since the programmer and the data-processor will need clear and unambiguous flowcharts and statements of the problem in the minimum of possible instructions without any superfluity, such logical formalisations will help the librarian to prepare his basic system ready for automation programmes in the library. Therefore some very simple logical concepts and the notation of the propositional calculus has been introduced in a step-by-step exposition and an endevour has been made to show their relevancy to formalisation of day to day language.

Statement and Prepositions and Their Truth-Value.

Any statement made about anything may be believed to be true or false. These statements are expressed in the form of sentences in the human language. Of course in human language there are other types of sentences, say, for example, the imperative or the interjectionals but we can say with reasonable accuracy that the vast majority of sentences are assertive or statement sentences or the negations to some other statement sentences. These again in the parlance of logic are said to be representations or expressions of logical propositions in natural language with definite truth-values.

When one says that all propositions or statements must be true or false it does not mean that this truth value should be or could be always determined from a correspondence with the reality. A much more important fact is the concept that whatever statement is believed to be true is true and whatever is not included in the list of such former statements is not true. If a verification of the statement whose truth-value is to be determined shows that it is incompatible wich one's list of true statements then the statement in question is not true. Therefore such question to the librarian as "Do you have the book logic and algorithms by Robert Korfhage in your library?" can be viewed as a verification whether the statement "The book Logic and Algorithm has been catalogued in the library" is true or not. A search through the catalogue list (where all information of books are recorded i. e. which is a list of true statements) now will prove the truth value of the above statement. In an automatic library the computer will determine truth value of such statements from the list of many true statements about a work that are recorded in the punch card or other recording media. For example, let us take two sentences like Logic by Tarski is in the library and Logic by Tarski and Logic by Suppes are in the library. These statements 1 and 2 may be represented by symbols P & Q respectively. If all the required information of the books in the library are recorded in punched cards the computer can read these cards and find out the truth values of P & Q. This operation seems very simple and trivial but is justified when the library must scan information of a large number of books and large number of borrowers. Thus sentences such as:-

1 "Have you ordered the book "Data processing in the library?"
2 "Does the subscription data of "American Documentation" expires on 1 May 1969" are transformed into statements like "find what is the truth value of the following sentences:

1 "The book "Data Processing" has been ordered in the library"
2 "The subcription expiry date of American Documentation is 1 May 1969". If we represent these two statements or sentences by the symbols L, M respectively then the question will be to find the truth value of L, M from our list of true statements. If the truth values are represented by 1 and O or T and F for true and falsity then symbolically we can write

$$L = 1 \quad \text{or } L = 0 \text{ ?}$$

$$L = T \text{ or } \quad L = F \quad \text{etc.}$$

Elementary Symbolisation of Compound Statements: connective not symbolished.

We have upto now only referred to statements and propositions without referring to their complexities. Different simple propositions are combined into bigger statements or propositions and we become concerned with the truth of this compound proposition together. All we can investigate the prediction of truth or falsity of the whole compound proposition if we know the truth or falsity of the constituent propositions or statements. Therefore representation of the compound statements or propositions are necessary showing the structure i. e. the constituent propositions and the nature of the connectives like 'and' 'or' etc. joining these simple propositions. And this structure can also be symbolised. Thus at an elementary level the following compound sentences or statements:

1 The book "Catalytic cracking" has been issued and is due by 3.9.69.
2 The book "Catalytic cracking" has been issued or is in the reading room.
3 Machines currently on the market can either be rented or purchased.
4 If there is no answer to the Ist reminder within two weeks then a second reminder is issued?

May be represented as

P AND Q (1)
P OR Q (2)
EITHER L OR M (3)
IF X THEN Y (4)

Similarly before symbolising such a sentence should be analysed. The sentence "If errors by a system study are corrected there will be savings from improved operation a part of which will pay for the effort involved in the study" may be analysed into the following statements (1) "Errors.... corrected" (2) "There....operation (3) A part.... study and if the symbols P, Q & R represent these statements respectively then the whole statement will look like the following

IF P THEN Q AND R (5)

(Then, and etc. were omitted in the main sentence)

Upper level symbolisation of compound statements: connectives symbolised.

Upto now only the constituent simple statements or propositions of compound sentences have been discussed. How they should be symbolised has also been noted. It might have been also noted that the connectors like AND, OR, IF.....THEN, NOT, IF AND ONLY IF etc. have not been symbolised. The next step would be symbolising them further both into the notations developed by Bestrand Russel (i.e. Principia notation) and by Jan Lusiewicz (polish notation). Both these notations and the system of logic to a certain level is intertranslatable.

The previous formulas will look as follows in Principia and Polish notations respectively:

The FORMULAS (1), (2)
(4), (5) will then look like
on further symbolisation
as shown here

OR

(1) P AND Q $\Rightarrow$ P. Q $\Longrightarrow$ Kpq
(2) P OR Q $\Rightarrow$ PVQ $\Longrightarrow$ Apq
(4) IF X THEN Y $\Rightarrow$ X $\supset$ Y Cxy
(5) IF p THEN Q AND R
$\Longrightarrow$ p $\supset$ (Q.R.) $\Longrightarrow$ CpKqr
$\Longrightarrow$ (P $\supset$ Q). R $\Longrightarrow$ Kcpqr

A few more symbolisations will clear the idea.

(1) Let the following sentences

"Logic by Tarski is in the Library"
"Logic by Suppes is in the Library"
be represented by the symbols r and s respectively.

Then $r.s$ = 'Logic' by Tarski and Suppes are in the Library.
$r.\vee s$ = Logic by Tarski or Suppes is in in the Library.
$r \supset s$ = If Logic by Tarski is in the Library then Logic by Suppes is in the Library.
$\sim s$ = Logic by Suppes is not in the Library.

(2) Let the following sentences or statements or propositions

"The acquisition Section communicates with circulation Section"

and

"The circulation section communicate with acquisition Section" be represented by P and Q respectively. Then the following statements will be symbolised as follows.

Acquisition and circulation do not communicate with each other $P.Q$

Acquisition and circulation do not communicate with each other... $\sim P. \sim Q$

Acquisition transmit records to circulation but circulation does not reciprocate $P. \sim Q$

['But' is a specific and stronger conjunction falling into the broader class of AND]

Neither Acquisition Nor circulation fail to communicate with each other ... ...$\sim(\sim P. \sim Q)$

[It is not the case that both acquisition and circulation do not communicate with each other]

Circulation can communicate with Acquisition on being informed by Acquisition ... $P \supset Q$

Acquisition and circulation can communicate with each other only and only on a mutual basis $P \equiv Q$

Some other sentences are also symbolised.

(1) It is easier to train a Librarian in programming than it is to train a programmer in Librarianship $\Rightarrow$ It is easy to train a Librarian in programming but it is not easy to train a programmer in Librarianship $\Rightarrow$ It..........programing AND it...........Librarianship $\Rightarrow$ P. Q....(6)

(2) This is not to say that Books cannot be both a container of information or an artiifa artifact of civilisation. $\Rightarrow$ It is not true that books cannot be both a container of information or an artifact of civilisation $\Rightarrow \sim(\sim P \vee \sim Q)$......(7)

(3) If a library operation is not large enough
1
to justify having A COMPUTER AT HAND

$\underset{2}{\underline{\text{THEN THE USE OF SERVICE BUREAU IS}}}$
$\underline{\text{A LOGICAL choice}}$ and $\underset{3}{\underline{\text{few of them are}}}$
especially if $\underset{4}{\underline{\text{information retrieval is not}}}$
$\underline{\text{involved}}$.

Now symbolising 1, 2, 3, 4, vy P,Q,R, S,

We have

IF NOT P THEN Q AND R
(ESPECIALLY) IF NOT S

Reorganising according to the real intent it becomes

IF ($\sim$P AND R AND NOT S) THEN Q

$\Rightarrow (\sim P.R.\sim S)\supset Q$ ......(8)

(4 It is recognised that Library administrators will be the ones who ultimately decide whether or not changes will be made in the existing system, but it should not be forgotten that it is the line stuff who will either make or break the new system through their attitude toward it and their ability to work with it.

Reformulating it in a more stilted form it becomes, (It is true that) $\underline{\text{If Library}}$
$\underset{P}{\underline{\text{administrators decide}}}$ THEN $\underline{\text{changes will be}}$
$\underset{Q}{\underline{\text{made in the existing system}}}$ OR $\underline{\text{Changes will}}$
$\underset{\sim Q}{\underline{\text{not be made in the system}}}$ ('or' in the exclusive sense) AND (it is true) IF $\underline{\text{the line stuffs}}$
$\underset{S}{\underline{\text{attitude pertains to it}}}$ AND $\underset{L}{\underline{\text{if they are worked}}}$
$\underline{\text{with it}}$ THEN $\underset{M}{\underline{\text{they will make a system}}}$ OR
$\underset{M}{\underline{\text{they will not make a system}}}$.

$\Longrightarrow$ IF P THEN Q$\vee\sim$Q AND (IF S
S AND IF L) THEN (M OR $\sim$LM)
$(P\supset(Q\vee\sim Q)).\supset(S.L)\ (M\vee\sim M))$
......(9)

Qnine explains very clearly the necessity of formalisation when he says that "the premisses and conclusions may treat of any topics and are couched to begin with, in ordinary language rather than in technical ideography of modern Logic. It is as an aid to establishing implications that we then proceed to mutilate and distort the statements introducing schematic letters in order to bring out relevant skeletal structures and translating varied words into a few fixed symbols such as 'and' in order to gain a manageable economy of structural elements, The task of thus suitably paraphrasing a statement and isolating the relevant structure is just as essential to the application of logic.........(P. 40).

Computer Language and Symbolic Language of P. C.

Similarly translations can be made from different formal Languages like the programming language into the symbolic language of P.C. This is because the symbolic language of P.C. itself with the minimum of connectives (i.e. the language of the Boolean Algebra) is used as a base of computer languages and programming languages. Thus an If statement in FORTRAN like

IF (X-A) 10, 20,

can be translated in P.C. as $(\sim P > 10)$.
$(P > 20)$

Where $P = X\text{-}A = 0$ 10 = Statement numbered 10.
$\sim P = X\text{-}A \neq 0$ 20 = Statement numbered 20.

Similarly it may be possible to investigate whether formal language statement in U.D.C. or 'Colon' can be translated into the language of Propositional Language.

Truth functions and Truth Tables

The concept of truth function and truth table has been used in many fields. This can be used also for rational construction of flow charts. We have told before that the truth and falsity of compound propositions depend on the truth and falsity of the constituent propositions. In the language of mathematics then it can be said that the truth value of a compound proposition is the truth function of its constituent prepositions. A tabular way by which these truth function and truth dependence of the constituent propositions and compound propositions may be represented are called the truth table.

Truth Table and Flow chart

The flow charting of a number of operations or simply the algorithming for doing a particular job can be rationalised if logical analysis is made with the help of truth table. A simple statement of a trivial library problem has been presented here to illustrate this. The problem is stated as follows:

"A library having 100,000 books has to send a list of books that are written by the modern American writers or the books that are written by modern Negro writers to some client. The library has an automated system (punched card system or computer) and information like author, author's nationality, title, date of publication etc. has been recorded for each book. A list of all relevant books are to be made. The problem is how to write most rationally a flow chart for making that list."

This problem may be reformulated as follows:

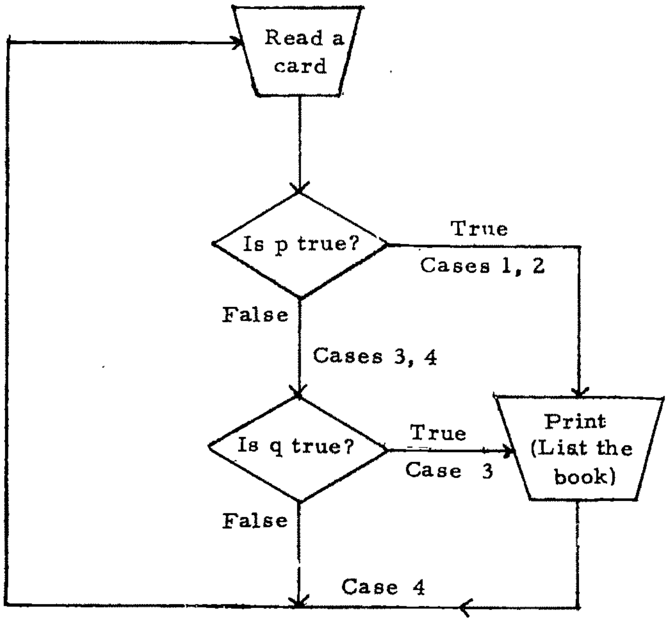
"To list the names of books that are written either by the Modern American writers or by the modern Negro writers."

$\Rightarrow$ If a books is written by a modern American writer or If a book is written by a modern Negro writer then its name is recorded in the list.

$\Rightarrow$ If (p or q) then $r \Rightarrow (p \vee q) > r$.

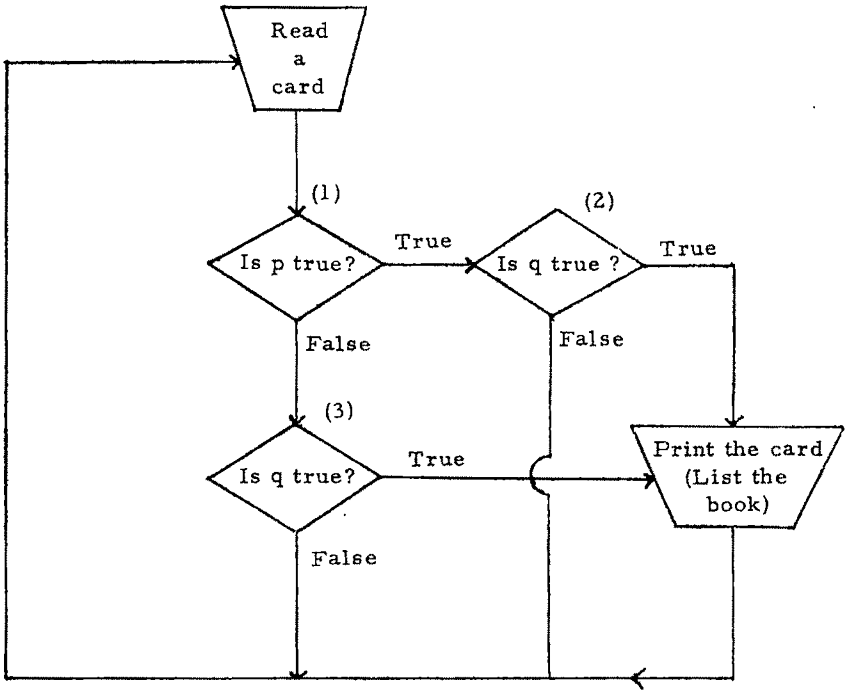
That means 'r' is true only when p v q is true. So whenever we will check from our records whether p vq are true we are to check always first for p and then for q. We may try to find also whether any shortcut is possible or not. Now if we see the disjunction truth table we will see that in case of horizontal columns 1 and 2 if we find that p is true then we no longer need the truth value of q for checking, since whenever p is true then p vq is true irrespective of the fact whether q is true or not. On the other hand in the 3rd column even if p is false p v q is together true. Therefore, in that q has to be searched for truth. On the other hand p v q is false only when q is false. In these two cases the truth value of p v q depends only on the truth value of q. Therefore, our instruction will be first to find all the cards where p is true; then we have to find out those cards where p is false and out of these cards to find out the cards where q is true and to reject the false q cares.

The whole process can be flow charted as follows:-



FLOW CHART OF (p v q) >r.

Now if we had not checked the basic truth table our flow chart would have looked like the following:-



We can easily see that here are three decision boxes instead of two in the previous flow chart. Machine time is shortened due to the elemination of the 2nd decision box. Moreover, in the second box when q was false we were returning those cards where p was true, on the other hand our list should have records in all cases when p is true. This is definitely a wastage. A similar such analysis can be made for the expression [(p v q). (r v s)] >1 or CKApqArs1

This expression means that a list is to be made whenever (pvq).(rvs) or KApqArs is true. A truth table is first constructed for analysis. This truth table has been built in Polish and the advantage of their use in drawing the flow chart will be clear.

Formula Conversion and Formula Reduction.

According to the basic tautologies or rules in Propositional Calculus most of the connectors can be converted to a few basic connectors by suitable manipulation or as is usually said strings can be formed' in the languages of logic. Thus, sentences with implication and equivalence connectives may be converted to sentences with only two or three basic connectives like Negation, disjunction and conjunction. They can further be reduced to only two i.e. either Negation (not) and disjunction (or) or Negation and Conjunction which is nothing but the language of the Boolean Algebra which the computer understands. Thus, it might be possible to remove all 'if..........then' or equivalence connectives in an ordinary language statement and to replace them by the 'not', 'and', 'or' connectives.

Propositional calculus provides us with rules by which smaller formulas can be expanded and bigger formulas reduced. This has got an important application in rationalising the flow diagram.

Thus an expression like (p v(p. q.))⊃1 may be reduced to by a combined method of conversion and truth-table analysis to (pvq) 1 which means significant simplication in flow charting. This type of manipulation may be used for a very interesting aspect of ordinary language data processing in the library i. e., the weeding out of superfluous sentences or propositions in an argument formula. This may especially help to find out from a set of instructions in a manual or administrative rule book the unnecessary and extra instructions which do not serve the real purpose of the instructions. This reduction method may then be used as an efficient tool for rationalizing administrative manuals. To give a taste of such type of problems we can start with part of probable administrative directive of a Librarian.

Minimisation of directives in library administration.

In an human operated system the superfluity does not count much as the human brain can process and distil the really necessary and relevant instructions and can operate economically with them. A relatively blunter man can go on following the rules strictly and since human labour is not so costly in some countries we can afford to bear the cost of an uneconomic set of instructions. But the problem really takes an enormous magnitude when in a big organisation like the army or a gigantic industrial complex a huge set of operations are to be performed most effeciently, most quickly, and where an enormous amount of manual making is involved. Here then all superfluities are to be weeded out, and only a streamlined set of instructions will be most effective in emergency situations. The problem is aggravated when machines are involved. Every step should be specified for the machine and any extra step due to cumbrous instructions or jumbled up set of rules will increase the machine-time thus increasing the cost factor. Any tool for the rationalising or correcting hastily formed manuals will then be of interest to the librarian standing on the threshold of automation. Logic provides such an analytical tool and to give a taste of it the famous "Commissar and the Samovar factory" problem will be restated in a language nearer to the librarian.

The librarian of a big library issues the following directives:

1) If a borrower keeps a book for more then two weeks then he must forthwith return it.
2) If the borrower does not keep a book for more than two weeks then neither he must return it forthwith nor he gets a reminder.
3) Either he does not get a reminder or he does not keep the book for more than two weeks.

After usual symbolisation of the compound propositions and their further compounding the expression can be converted to an expression with only negation, disjunction and conjunction signs and by suitable manipulation and conversion back to the implication formula it can be proved that only the following directives were necessary:

1) If the borrower keeps a book for more than two weeks then he must forthwith return it.
2) If the borrower returns the book forthwith then he does not get a reminder.

Logical Possibilities and Network of Library Operations.

When several statements are considered together then there is a problem of arranging them in hierarchical order as according to their importance, order of performance etc. In short each proposition is made in relation to certain logical possibility the relative weights of the logical possibilities of different propositions are necessary for determination of the optimum path (with lesser risk) in different types of communication networks. In order to show logical independence or dependence of different statements in a compound sentence such an analysis is necessary. Tree diagrams are very useful in such analysis of logical possibilities. Trees can be suitably utilised for visualising the steps in a mechanical classifictory device. Whenver, while performing a number of operations in a time sequence, a decision is to be made at any step for determining the optimal path towards a goal (so called 'maze problem') then tree diagrams can be made with profit. It is reasonably hoped that in a library such type of operations in a time a sequence in a hierarchical order are performed where at certain steps of decision making logical analysis is necessary. The optional structure of the workflow in a library can be chosen also by such an analysis.

Logic and system design in the library

In the previous dicsussion we have put forth details of the preliminary Logic-mathematical analysis that can be done or should be done along with the preliminary analysis of information processing system in the library. There is scope for doing other types of mathematical analysis like the application of set theory in this regard.

The importance of preliminary data processing and the tools necessary for this purpose has been always stressed by librarians whenever they were faced with the problem of automation. But the necessity of mathematical analysis has not been so far stressed in the day to day operation analysis in literature.

The automation of libraries should begin with logical and mathematical analysis of the routines. For this the actual situation in the library should be studied and the verbal exposition should be analysed and formalised. Real and not imaginary work flow and communication network of the library should also be constructed.

Such type of studies we hope to undertake soon by processing data from the actual life situation.

Acknowledgements.

Author is grateful to Shri B. S. Kesavan, Director, INSDOC for permitting him to participate in the Seminar 'On Automation Problems in University and Special Libraries' through this paper. The author also expresses his earnest thanks to Shri T. N. Rajan and Shri B. Guha for their clear and simple expositions of the problems in the library from which the author profited greatly.

A NOTE ON THE NEED FOR AUTOMATION IN CATALOGUING

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[Abstract only]

In the absence of a good catalogue, time is being wasted in all the libraries in the country in putting the right book in the hands of the right reader at the right time. Automation in cataloguing means cutting short the distance in terms of time, space and even language between the documents and the users of the documents.

DISCUSSION

Mr. Mangla: Mr. Deshpande's problem seems to be essentially regarding making of duplicate entries. Cataloguing as such has to be done by professionals and there the computer is of no use. He suggested that for duplication of entries some simple gadget can be used instead of computers which need import from foreign countries.

Mr. Dhanpat Rai: The job that has to be done by a cataloguer cannot be done by computer. However clearing of arrears can be quickened by the use of tapes and printing of cards. Various epxeriments are being carried out in the University of New Castle Library, and University of Baston Library. Deutsch Bibliographie is being produced by computer. We have no experience in this field which is very much needed.

Mr. Raizada: Dr. Vajifdar's experiences with 'Striple Catalogue' may be of some value to the problem of arrears in cataloguing.

Dr. Vajifdar: This experiment started twelve years ago and is the only one of its kind in India. In this system all rules of cataloguing have to be given up. The interest of the reader is the guiding consideration. The experiment proved useful. Readers interest include the following items like Author, Title, Date of Publication, specially in the field of science, and Publisher. Therefore each entry included class No., Author, Title, Series in hand, year of publication and Accession number in bracket. This type of catalogue is very useful and requires small space for storage. Again it can be used by many people at the same time. The only draw-back is that it is very expensive. Strips have to be imported. Local markets are being exploited. However, in comparison to other types of catalogues and their usefulness the extra cost is justified.

Mr. Goil: The modification in cataloguing is caused by user's reaction. In his case the library committee after nine years decided to make certain changes in the traditional catalogue. They wanted that 'Imprint' and collation should be included in all the catalogue entries. How the authorities expect a miracle as regards arrears which have been accumulating for the last fifty years? For this, time and staff is required. How computer is going to help in this has to be explored.

Mrs. Johnson: The Lack of cooperation is the main problem as regards her experience in India and U.S.A. Each library classifies and catalogues the same publications individually and thus duplicating efforts. Library of Congress Catalogue is available on cards and tape. It will be good if these cards carry Dewey No., U.D.C. No., C.C. No., in addition to Library of Congress Classification No.

The Chairman: At Baroda University Library, Library of Congress catalogue cards are used. It became necessary because of shortage of time and staff. Dr. Shukla of the Baroda University Library solved the problem in the above manner instead of resorting to the use of computer. I thank all the authors and the participants, for a lively discussion.

PREPARATION OF INDEXES

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Indexing is an essential activity in any information and documentation service. Computerised indexing yields economical, faster and accurate results. Enumerates the areas of further work in computerised indexing. Presents cost analysis for preparing monthly and yearly indexes to Indian Science Abstracts.

INTRODUCTION

Considerable literature exists on indexes and the art of indexing. At least one periodical is completely devoted to indexing. In the field of documentation and information work, indexing forms a major operation. It is an essential and costliest bottleneck in these services. Even traditional cataloguing work in a library may be viewed as an activity resulting in a series of indexes. Consequently, indexing, with the aid of computers drew considerable attention particularly in America and a substantial portion of literature on computerised documentation pertains to it. The terms like KWIC, KWOC, KWAC, etc. are common terms these days not only with librarians and documentalists but also with the community of the users of information service. Therefore, it is only natural that indexing should occupy a high priority in the study programme of Insdoc on computerization of information processing.

INDEX

One of the most difficult and essential tasks is that of defining the activity or the concepts in any field of enquiry. It is difficult because a concept or an activity can be defined in more than one way and each definition is equally true, with the result that no single definition is all embracing. The difficulty lies in providing a comprehensive set of definitions. For the present purpose, an Index may be considered to be an ordered set of items of information extracted from a larger set of items of information, having a different order, with a view to provide direct access to information in the larger set. In other words, an index is an information store pulled out of bigger information store, the arrangement of information items in two stores being different. An Index provides direct access to an item of information without the complete scanning of the information store such as a document, a book, a periodical or a library. Thus an index has three basic components viz. 'information' item', 'arrangement', and 'facility for direct access' which may be called address or location.

INDEXING

In this sense, indexing is a process of extracting and selecting items of information from the information store, ascertaining and fitting the address or location of the item in the store and arranging the selected items along with their addresses in a desired sequence. Hence, the process of indexing can be viewed to consist of the following operations:

1. Scanning of the information store and the selection of information items or index terms;
2. Ascertaining the address of the index term in the information store and fitting it to the index terms;
3. Sequencing all the selected terms in the desired sequence; and
4. Presenting the sequenced index-terms to suit the mode of communication and dissemination.

Thus, basically, indexing implies the building up of an equivalence table.

TYPES OF INDEX

Depending on the agency responsible for the preparation of an index, there are three broad types of indexes viz., manual, computerised, and hybrid. Each of these categories may result in indexes such as author, subject, town, place or geographic indexes. From the sequence point of view, indexes may be grouped as alphabetical, number, or special indexes.

TECHNIQUE OF INDEXING

On account of the selection involved in indexing, there arises the technique and the art of indexing. It comprises the following discrete operations.

1. Reading the document which may be a line, a para, a page, a section, or a chapter of a document.
2. Selecting an index term on some basis. It is here, that human ingenuity, skill, art and expertise is called for mainly on account of vague, undefined, ambiguous rules for the selection of indexing terms;
3. Recording the selected terms on suitable media according to available rules of grammer. These rules too are ambiguous thereby raising the decision problems;
4. Fitting the index term with its address and recording on the same. The address may be the line number, paragraph number, section number, page number or chapter number in a document;
5. Ascertaining that all the documents have been completely scanned;
6. Sequencing these recorded items in the desired sequence which may be alphabetical (for names of persons, places or things) or numerical (for numbers) or special (for class numbers etc.); and
7. Editing the sequenced terms to suit the dissemination requirements like appearance, column width etc. This may involve operations like merging etc.

PRACTICE AND PROBLEMS IN INDEXING

The normal practice in indexing is to select a single word indicating the concept as index term. Frequently, two worded terms are also selected, in this case one of the words is a qualifier or adjectival. Now these words are removed from their sequence of normal occurrence in the text and are put in different sequence in an index to suit a different purpose. In this process, the original semantics of the word are lost. The main problem lies in retaining the original semantics of the word, even in the event of isolation of the term and the changed sequence of presentation. At present, this is being done by retaining the entire context as in KWIC, by providing the context by an artificial number like class number etc., or by reconstructing the context with the use of roles and links. It must be pointed out that none of these is entirely satisfactory.

COMPUTERIZATION

Without tracing the historical course of the application of computers to the preparation of indexes, it may be said that computers are being used in the entire routine, enumerated under technique of indexing, as a whole or in isolation to one or more operations. The result of computerisation is that indexes are available at a faster rate, with greater accuracy and consistency, and with less human tears. These indexes are easier to consult though not upto the mark from classical and traditional view point. The shortcomings of computerised indexes are mainly due to the lack of unambiguous rules of the selection of index terms on the part of humans, and non-availability of text reading machines which increases the conversion load many times if the entire text is to be read and scanned. The prohibitive conversion costs make it essential that only the most significant portion of the text be scanned by the computer. This is normally a title or an abstract. It is seldom the entire text.

ISA INDEXES

Insdoc has computerised the preparation of the Author and the key-word Indexes to ISA (= Indian Science Abstracts). The work on computerised indexes started during 1967 with the second volume of ISA. The preparation of author index was the first to be computerised, followed by the preparation of key-word index. The details of these have been published in the Annals of Library Science and Documentation, 1967. The cumulation of annual indexes has now been undertaken and the Annual index for 1967 has already been compiled. The annual cumulations for vol. 1 and 2, 1965 and 1966 are being undertaken. In this compilation and processing of indexes to ISA the mode has been a hybrid one. This is to say, that the selection of index terms is done manually by expert abstractors. The computer is used for alphabetisation, and editing the alphabetised index for the purpose of printing the index. In this manner, judicious selection by human agency is retained. The computer is used in doing away with the labour of alphabetisation, decreasing the preparation time of the indexes and increasing the accuracy by minimising typographical errors. Further, the computerised output saves considerable time at the column, page and board layout stages and practically no further corrections are needed. The computerised preparation of monthly indexes takes less than six days to prepare the final press copy and costs about Rs. 400/- per issue. The annual index costs about Rs. 1500/- and takes less than six hours on IBM 1620 computer.

It has not been possible to eliminate the defects from these indexes. Mostly the defects being the inadvertent inconsistencies at the selection stage. These can be minimised by formulating proper and unambiguous codes for the selection of index terms and a strict adherence to the code by the indexer.

CONCLUSION

At least one area where the computerization can be effectively used is the indexing of secondary periodicals. It is economical, fast and accurate. The experience gained at Insdoc during the past two years demands further work in the following areas:

a) Identification and formulation of the rules governing the selection of the index terms from the view point of the purpose of the index;

b) Syntactical modifications necessary in the index terms in order to minimise the scattering in the index;

c) Formalisation of the above set of rules;

d) Techniques of keeping the semantics of the index-term invariant in the sequence transformations; and

e) Developing ready made programme-package for 'off-line' indirectly connected computer facilities available to library and information centres in India.

ACKNOWLEDGEMENT

The authors are grateful to Shri B. S. Kesavan, Director, Insdoc, for his encouragement in computerising the ISA indexes and providing this opportunity for the exchange of thoughts. They are thankful to their ISA colleagues for their frequent discussions and useful suggestions which had gone a long way in the task of preparing these Indexes with the aid of computers.

COMPILATION OF COMPUTERISED INDEXES - NEED FOR BROADER GUIDELINES AND CRITERIA

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Describes the introduction of a new concept of computerized indexes. Surveys the problems arising from the compilation of such indexes with reference to Keyword Index to the Handbook of ISI Publications. Discusses the need for revision of IS:1275-1958 'Rules for making alphabetical indexes' in the light of this new concept and establishing certain guidelines and criteria for the compilation of basic data for such indexes.

INTRODUCTION

The index forms an essential part of a publication since it is an important main tool for retrieving information on the subject. The index also provides a systematic and consistent subject analysis of the contents arranged according to alphabetical, chronological, numerical or any other order. Though author and subject indexes have come to be accepted as an essential part of a publication, the type of an index is determined by the type of the material to be indexed and the use to which the index is to be put.

In an index, each entry (a unit of index consisting of a heading with at least one reference to the location of the item in the text) is followed by page number, paragraph number or other indication of the exact location of the reference. Unlike the general belief, an index is not a mere listing of words, concordance, table of contents, glossary or checklist arranged in a particular sequence.

NEW CONCEPT IN INDEXING

Indexing techniques are currently undergoing a kind of revolution. Maps, pictures, records and even fingerprints are being indexed along with books, periodicals and technical documents. With the advance of automation, mechanized indexes are fast taking place of manual indexes. Use of computers in the compilation of indexes has broken new ground. This specially applies to the compilation of neat, accurate and efficient indexes of voluminous serial publications in a record time.

MECHANIZED KEYWORD INDEXING

One of the popular brand of mechanized indexes is a KWIC (Keyword in Contex) index. It is a machine generated permuted index, based on title citations. This presupposes that the title consists of significant words to make it meaningful. After the title is keypunched, machine-readable record in the form of punched cards is fed to the computer. The machine selects keywords by using a thesaurus of keywords, which has been transferred to its memory.

INDIAN STANDARD ON INDEXING

The Indian Standard Institution issued in 1958 an Indian Standard IS:1275-1958 'Rules for making alphabetical indexes'. This standard lays down rules for preparing alphabetical indexes of books and periodicals, but it does not cover special indexes like chronological indexes for history books and case indexes for law books. The standard is divided into three parts. Part I covers general requirements for the structure, entry, heading, index numbers, features of entries and layout of the indexes. Part II covers the formation of indexes of books while Part III deals with the preparation of indexes for periodical publications. The three appendices at the end give examples of alphabetical indexes, recommendations for the preparation of indexes and definitions of terms.

INDEX TO THE HANDBOOK OF ISI PUBLICATIONS

ISI brings out a Handbook of Publications every year. The current edition lists some

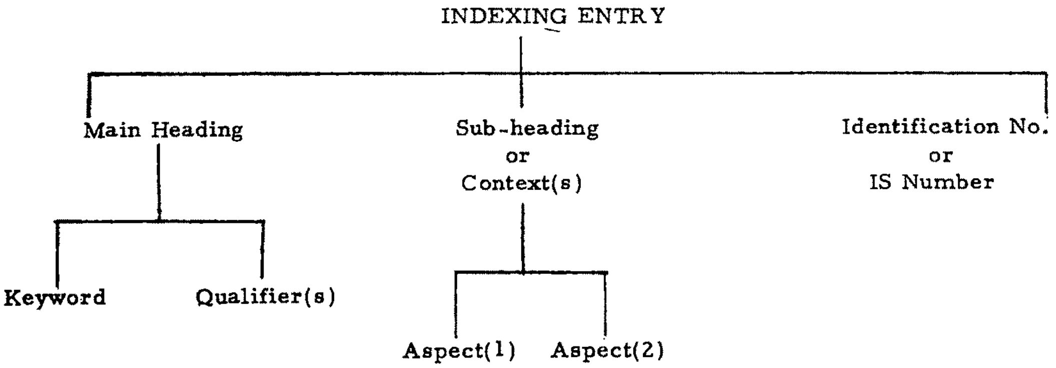
5,000 Indian Standards apart from 1,000 ISO Recommendations and IEC Publications. Till 1967, this publication had a manually prepared index to serve as a guide to the numerically arranged titles of the standards and specifications. In the absence of any other reference tool, the index served the purpose of a key to literature search and retrieval of information on the subject. Each year, the index was compiled so as to cover the requirements of a subject index, catchword index, series index and alphabetico-class index. As a result, more than 15,000 entries at the rate of nearly four entries per title had to be manually processed. Even after devoting four to six months' time for this tedious work, the job remained imperfect. The manual process thus was not only time consuming and expensive in terms of manhours spent on the job but also considerably delayed the publication of the Handbook.

COMPUTERIZED INDEX FOR HANDBOOK

In 1967, INSDOC was approached for their collaboration in the compilation of this index with the help of a computer in the light of their experience of compilation of index for Indian Science Abstracts. The index was envisaged to be a KWIC (Keyword in Context) index because keywords without context do not adequately clarify the scope and contents of the subject. Besides, this makes the index more explicit as the same keyword may occur in different subjects.

For certain reasons, the computer was used only for a part of the operation, that is alphabetizing the entries and printing them in the shape of a master copy in 70-character index lines. The index entries were prepared manually as before; they were than punched on IBM 80-column punch cards and processed through a digital computer (IBM 1620).

The formation of an index entry is standardized. It consists of (a) main heading which includes keyword and qualifier(s), (b) sub-heading or contexts which include(s) one or more aspects, and (c) identification number (IS No. in this case). The following schematic representation would illustrate the scheme:



Main Heading

The main heading consists of a noun (or a phrase) called keyword, or a noun qualified by one or two adjectives termed as qualifiers.

Example

PORTABLE FOAM TYPE/FIRE EXTINGUISHERS

Qualifier / Keyword

Selection of keywords in this index is made from the title of the Indian Standards and all the possible catchwords or essential words in the title covering important aspects of the subject are indexed. 'Qualifier(s)', a word or group of words (adjectives or adverbs), which generally give(s) the functional or descriptive aspects of the keywords are separated from the keyword by a comma.

Example

(FANS, ELECTRIC/FOR DOMESTIC USE)

Context(s)

It is a brief description of the subject in addition to the keyword. The context is made as brief as possible by using only essential words, abbreviated terms, minimizing conjuctions and eliminating articles, whenever possible. It is separated from main heading by placing it below.

Example

LIFTS, ELECTRIC

OUTLINE DIMENSIONS FOR

PROBLEMS

The mechanized index was expected to be a general index including the aspect of the subject, catchword, series and alphabetico class index. But it did not quite meet the needs of the users. The compilers too were not satisfied. However, limitations like absence of lower case types, chemical symbols and Greek letters in the computer are well known. These were overcome by spelling out the letters.

For Example

BETA-OXYNAPHTHOIC ACID

PARA-NITROTOLUENE

In the final format singular and plural forms of the keyword cause some ambiguity. This difficulty can possibly be overcome by using singular form of the keywords. However, in exceptional cases where singular form of keyword changes its meaning or significance plural form has to be retained.

For Example

LICKS FOR CATTLE

FORCEPS, DISSECTING

A very peculiar problem is with regard to format and style. In fact, the mechanized index violates certain established practices followed for manual operation.

For Example

QUALITY CONTROL UNDER PRODUCTION

Problems also arise regarding vocabulary control and it needs elaborate planning of the terms before punching the index entries. There is also no scope of see and see also references. Without such references the index remains incomplete.

For Example

BHINDI has no see also reference under OKRA

The length of keywords and their contexts, if not limited also pose a basic problem as the present programming schedule has certain limitations.

For Example

TEXTILE MATERIALS, DETN OF COLOUR FASTNESS

CONCLUSION

The quality of an index is determined largely by the maker's appraisal of the kinds of materials contained in the collection, the range of search questions likely to be posed by users and the mechanism available for searching the collection and the consequent adoption of the index to the needs of its users.

The present system of mechanised indexing, which is likely to be more and more popular and useful, calls for the formulation of basic guidelines and criteria. This will necessitate modification of IS:1275-1958 'Rules for making alphabetical indexes'

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Z39. 4-1959 'Basic Criteria for Indexes.' American Standards Association.

DISCUSSION

Dr. Sharma: What is the difference between the index prepared by a computer and the one prepared mannually.

Mr. Saxena: Basically there is no difference and that the structure of the entry is same with the exception that in certain cases of computer produced index, entries are to be modified to overcome the limitations of computers. The entries in computer prepared index are arranged letter by letter only.

Mr. Malwad: What are the actual programs used? What are the broad outline of the methods and the flow charts used in the programs etc.?

Mr. Raizada: These aspects are dealt with, in detail in the Annals of Library Science and Documentation 1967, 14(1), 20-33.

Mr. Phadnis: The computer produced indexes are very essential in the light of large literature that is being published.

Mr. Kapoor: Is any thesaurus being used for preparing the index of Indian Science Abstracts?

Mr. Raizada: So far, no thesaurus has been used. A thesaurus will be developed in the course of coming years using the experience gained in the preparation of three years annual indexes of Indian Science Abstracts.

Mr. Dhanpat Rai: Are Indian Science Abstracts indexes being used for answering queries from outside?

The Chairman: Indian Science Abstracts may not be that much useful in physical sciences as the medical and biological sciences and that after a couple of years Indian Science Abstracts may start entertaining outside queries in medical and biological sciences.

Mr. Srinivasan: How has the problem of italicising the index entries been tackled in computerised index?

The Chairman: One refers an index, one looks for the word only and is not bothered about the typography and as such this is not a problem at all.

Mr. Malwad: Has Indian Science Abstracts faced any major difficulty when it switched over to computer indexing?

The Chairman: No difficulty was faced except for the Greek letters and certain chemical names which were tackled without much difficulty.

DISCUSSION

NEED FOR THE DEVELOPMENT OF A SPECIAL PURPOSE COMPUTER FOR LIBRARY AND INFORMATION WORK

SESSION - G: LIBRARIANS' VIEW

The view of the librarian was put forth by Shri Dhanpat Rai. The two broad categories of works for the computer in a library are:

i) Compilation of indexes and related works.

ii) Information Retrieval and related works.

These functions can be made fairly routine. The need in different forms in libraries of computer justifies the need for a special purpose computer. Two start the experimentation we do not worry much about the cost of such a device. But attention is to be there in making such a machine suitable for above mentioned areas and making it cheaper.

The results of the experimental project MAC on time sharing and TIP for mechanized IR show that it is worth undertaking such experimental projects.

The improving technology in computer hardware and constant improvement over such a special purpose computer may yield a good outcome through this experiment.

SESSION - H: VIEW OF THE COMPUTER SPECIALISTS

Mr. Kapur: In view of the limitation imposed by library routines is there a possibility of designing special purpose computer? Nowadays tendency is to use special purpose computers for specific jobs. The memory of the computer is just like library, and information is stored in it in such a way that it can be retrieved quickly, in other words, library is a information system. Before deciding the design of special purpose computer one should be clear about the functions of library and information work which are to be computerized. It will not be economical to have complete automation and as such semiautomatic methods find a good place in this field. With a view to create computer consciousness in librarians, we should introduce some preliminary methods like hand-punched card system, coding etc. which would ultimately lead to complete automation.

Dr. Nag: I do not agree with the idea of Mr. Kapur making librarians computer conscious by introducing hand punched card system, coding etc. These will be too elementary methods and they will not help in solving complex problems in the fields of information retrieval. Somebody should take up the project on electronics for generating code pattern. This project may need keyboard and magnetic tape which are easily available in India. There are quite a few active groups working in this field at various major computer centres in India and one of them can easily take up this project. We should first select the areas of the library and information work which need automation and then only can think of the design of special purpose computer.

DISCUSSION

Dr. Bhan: Besides giving stress on software, hardware should also be given importance and that is being done in the fourth generation computers. Taking into consideration the high cost of special purpose computer it is better to go in for hardware for the special purpose e.g. information retrieval. While designing, following points should be given due consideration: a) Protection of the files b) Structure of the design c) Updating the files and correcting the errors d) Certain routines which are being done by software, can be done by hardware, e) Better integration of the software and hardware.

Mr. Ralhan: It is difficult to provide special purpose computer because of high cost and very small area of its application. It is not possible to work out the cost of an automatic system and comments about its economies before introducing it. In computerization, though the cost involved is high but it gives the results at a very fast speed and as such its applications in research and commercial fields should be preferred, thereby saving a good deal of time and making the job much simpler. Finally whatever the design may be, attention should be given to special instructions and the system should have a fast through put device.

Mr. Radhakrishnan: I need not further stress the introduction of automation in library and information work as it has already been experienced that its need is inescapable and that some work was already being done at Insdoc and TIFR. There is need of special purpose computer and it should be equipped with the following features: a) Character oriented machine, b) Given the keyword, it should be possible to select the information with single instruction, c) Language for the system should be based on search strategy. The fields of library science and computer science are evolutionary and to understand each others problems better and clearly computer science courses should be organized for librarians and similarly library science courses should be arranged for the personal connected with the computer science.

The Chairman: The computer consciousness should be created in persons working in library and information retrieval fields. He suggested that librarians should keep on using the available computer facilities for their work. He added that early steps should be taken by interested organisation to take up the project for designing the special purpose computer for library and information work.

Review

Public library movement in Baroda, 1901-1949, a doctoral dissertation, Columbia university, by Murari Lal Nagar. Columbia (Missouri), International Library Center, 1969. xiii, 371p. Rs. 50/ - [Reviewed by B Guha].

"They [the people] must be brought up to love books, not simply attractive bindings or pretty pictures, but their contents. They must be taught to regard books as a part of their lives. Libraries will not then appear a luxury, but a necessity of existence". These words appear to be so relevant even in the context of present-day India that one would hardly believe that these are the words of Maharaja Sayajirao of Baroda said on an occasion as far back as 1912. He not only said this but what is more important did everything possible to realise this goal of making libraries a necessity of existence. The result was the development of such a well organised public library system in the state that Baroda's American library expert - William Borden said, "What America could only dream of, Baroda could do, and in a measure has done".

In this dissertation Dr Nagar admirably depicts this extremely impressive picture of library development in Baroda. But this is not merely a rehearse in the history of this glorious past. Dr Nagar has a point to prove. The ideal burden of his thesis is to seek answers to the frequently asked questions, such as - "was the library movement fundamentally a failure, was the movement so narrowly dependent upon the Maharaja that with his death in 1939 the movement too died, or did some other factors contribute to the decay? This has, however, not been an easy task. A number of old government files, records, circulars and other documents have been searched and consulted to get information. The author even contacted Mrs Helen Borden, Borden's daughter-in-law, to see the papers Borden had brought from Baroda but only to be informed that those papers were destroyed just a few years ago. However, he had better luck with the Baroda government records. He could salvage valuable papers from "piles of papers stacked in corners, almost assuming the scene of a heavy stock of wastepaper" all about to be destroyed. It is really gratifying to note that these precious documents have been made of use of in this thesis.

Coming to the main contents of the dissertation, as has been said before, Dr Nagar has tried to dispel the popular belief that the library movement was too narrowly dependent upon the personality of Maharaja Sayajirao to have long survived his personal rule and also the library policy of the post-Sayajirao Government was not conducive to effective library service. His own findings are that the movement was not exclusively dependent on the personality of Maharaja Sayajirao, that the decay had already crept in even while he was alive, that some progress at the previous level was maintained even beyond 1939, and that the post-Sayajirao Government of Baroda was equally interested in the development of libraries. Further, the library movement in Baroda was not a total failure, as all the libraries in Baroda did not die; it is the system that died. The final cause for the total disappearence of the system was the merger of the state of Baroda with Bombay which did not subscribe to the library policy of the Baroda Government.

On the question of the library movement being too narrowly dependent upon the personality of the Maharaja, critics have gone to the extent of saying that, "the incentive for the establishment of libraries in Baroda did not come from the people. Libraries, in a sense, were imposed on them". But Dr Nagar points out that the policy makers were completely aware of such a situation developing and even anticipated such criticism and did everything possible to ensure that the demand for libraries came from the people. This is clearly brought out in a writing of William Borden, wherein he remarked, "These libraries were to be for the use of the people, not for monuments to the Maharaja. In order to have them used, the citizens must first be brought to want them, and want them badly enough to be willing to contribute a good part of the expense out of their own pockets". Thus the instrument for government action in this matter was that the people of a locality had to come first with one-third financial contribution before the state would provide the other two-thirds in association with the local boards. The response was so overwhelming that it became difficult for the

Government to keep up its own end. In fact the Government had to put a ceiling to the number of new libraries that could be established in a year. Hence, there can hardly be a question of 'imposing libraries on the people'. Further, Dr Nagar has tried to prove that the library movement originated as a people's movement under the leadership of a public leader, Motibhai Amin, in the form of Mitra Mandal (Society of Friends) libraries as early as 1906 and state patronage came only in 1910.

However, as the possible cause of decay of the system, Dr Nagar puts emphasis on two important factors in the organisational and administrative structure of the government machinery which failed to ensure continuity and direction in the growth and maintenance of the libraries. Firstly, the Library Department of Baroda was a part of the State Government. Had the management been vested in an autonomous statutory body, representing different interests, things might have been different. Also, the Library Department had no device to prescribe standards of service or to enforce them. Secondly, the device of voluntary contribution as the sole index of people's enthusiasm and participation also contributed its share to the ultimate decay of the system. The contributions could come from only a section of the people, the comparatively richer section, and in course of time they formed a privileged class with some extra facilities and rights in the affairs of the library. This was detrimental to the spirit of free public library. In this connection Dr Nagar goes into the question of a library tax and tries to find out why the planners of the Baroda public library system avoided the levying of a library tax and depended exclusively on voluntary contributions.

On final analysis, it is said, the example set by the pioneer public library movement in Baroda excercised a wholesome influence on many other regions of India.

It is not only due to the nature of the subject but more due to the excellent and novel treatment of the subject that the publication will be a very useful addition to any collection on library matters.

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